THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXIV. No. 588.] LONDON, AUGUST 18, 1874. [26th Year.] Price 6d.

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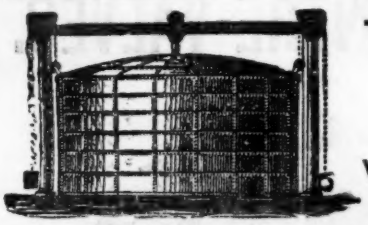

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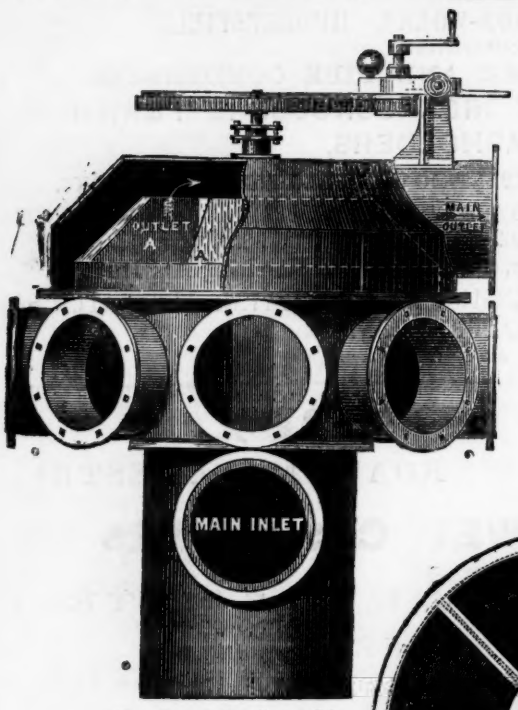
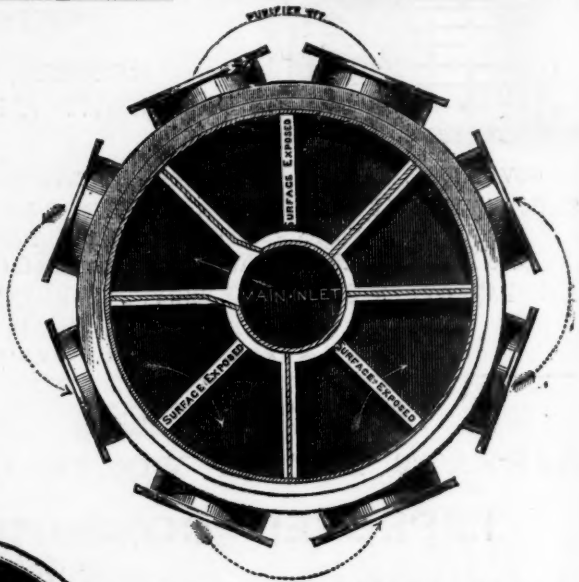
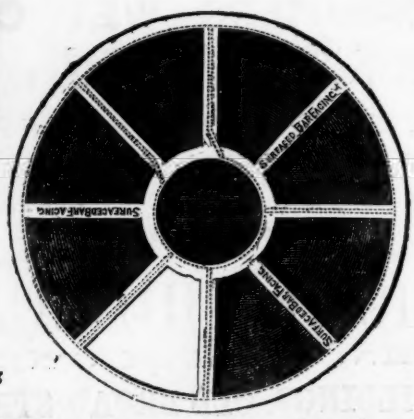
C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.



Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

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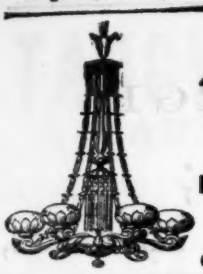

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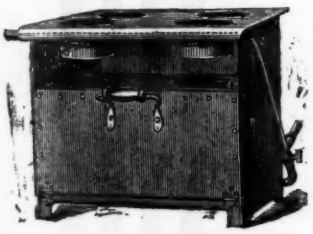
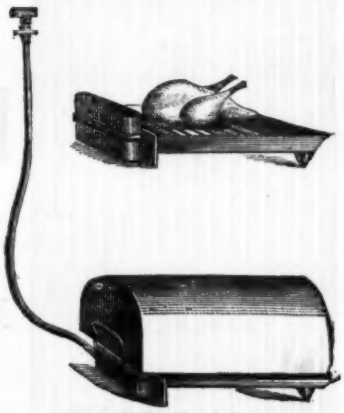


SMALL RANGE.

LARGE RANGE.



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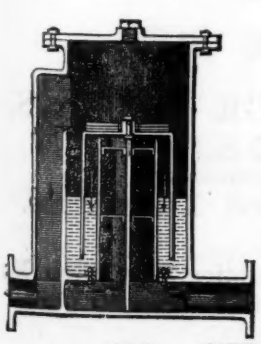

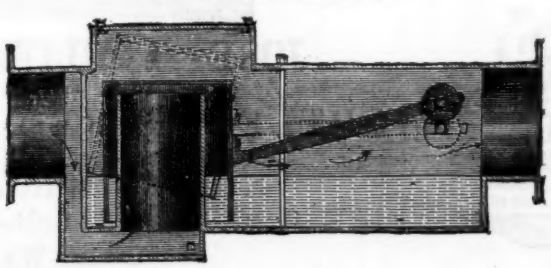

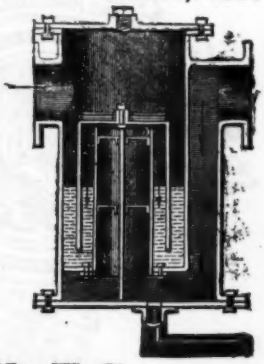

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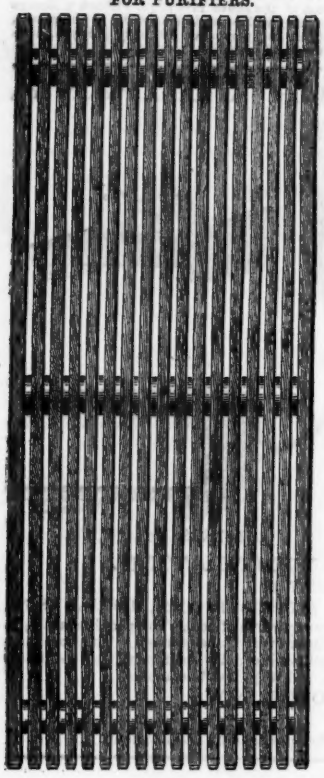
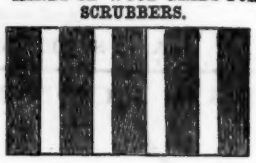


VERTICAL SECTIONS OF THREE KINDS OF WOOD GRIDS FOR SCRUBBERS.



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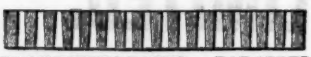
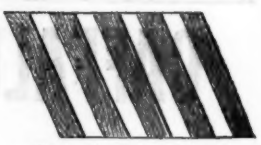


MADE EITHER TAPER or PARALLEL
WITH SQUARE OR ROUND DISTANCE BLOCKS.



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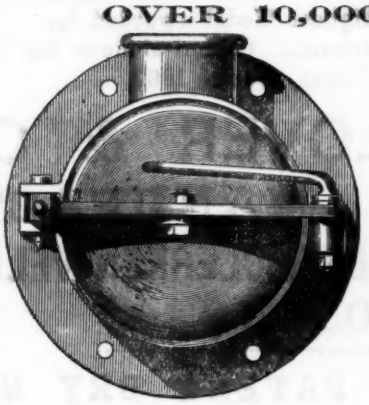

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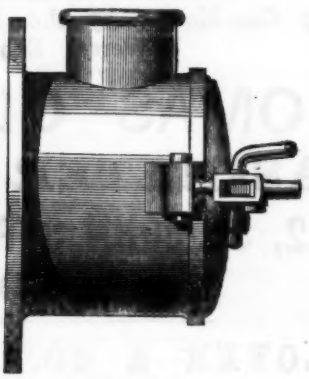

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„ London Gaslight Company.	„ Gas-Works, Arsenal, Woolwich.	„ Liverpool United Gas-Works.	„ Ystrad Gas-Works.
„ Independent Gaslight Company.	„ Commercial Gas Company.	„ Birkenhead Gas-Works.	„ St. Alban's Gas-Works.
„ Phœnix Gaslight Company.	„ Alliance and Dublin Gas-Works.	„ Birmingham Gas-Works.	„ Over Darwen Gas-Works.
„ South Metropolitan Gaslight Co.	„ Edinburgh Gas-Works.	„ Nottingham Gas-Works.	„ Aylesbury Gas-Works.
	„ Manchester Corporatn. Gas-Works.	„ Newcastle-on-Tyne Gas-Works.	„ Cardiff Gas-Works.

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I am, yours truly,

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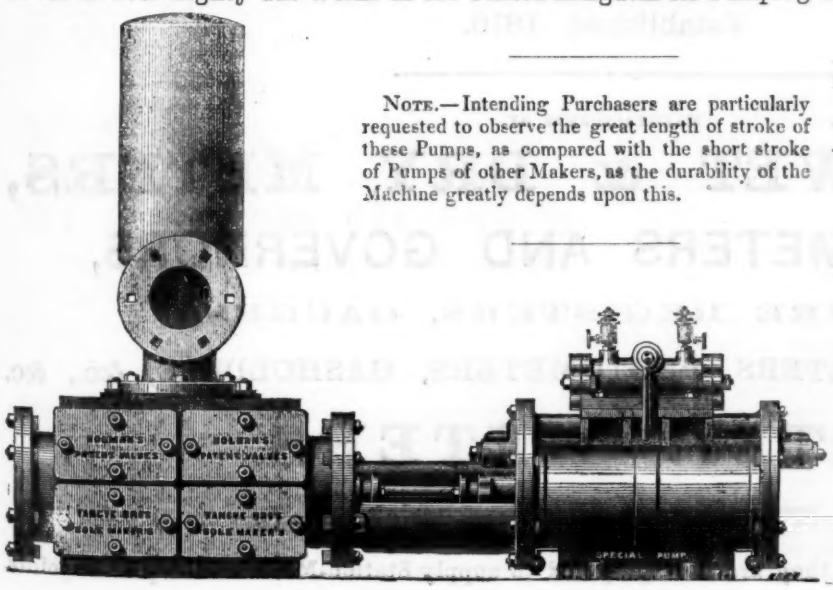

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6	4	12	3,900	30
6	5	12	6,100	35
6	6	12	8,800	40
7	5	12	6,100	40
7	6	12	8,800	45
7	7	12	11,900	50
8	4	12	3,900	40
8	6	12	8,800	50
8	8	18	18,660	65
10	6	12	8,800	60
10	8	18	18,660	75
10	10	24	24,400	100
12	6	18	8,800	75
12	8	18	18,660	85
12	10	24	24,400	120
12	12	24	35,240	140
14	8	24	18,660	120
14	10	24	24,400	140
14	12	24	35,240	160
16	8	24	18,660	140
16	10	24	24,400	160
16	12	24	35,240	180

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

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No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 18, 1874.

Circular to Gas Companies.

THE "silly season," as some one has pleasantly called it, has set in, and the daily newspapers now open their columns freely to correspondents. That complaints against gas companies should constitute a topic for some writers is not to be wondered at; but as a specimen of most unreasonable grumbling, we may quote a complaint against the Chartered Company, for having changed their western supply from cannel to common gas. There can be no doubt that the change has been in every way beneficial to the consumer, who gets cheaper gas, and will see no difference in the light he has now and that he formerly obtained, if he will only use an appropriate burner.

The Chartered Company have, very properly, issued a circular, pointing out to their customers the best kind of burner to use with the new supply, and it is coolly asked "whether they are "prepared to bear the whole expense which will be caused "throughout their district by the change of burners." The answer to this and all the other queries is perfectly clear. The change was made on the authority of an Act of Parliament, and is distinctly in the interest of the consumers. All the company are required to do is to enlarge the service-pipe if necessary. For the rest, the consumer must look after his own interests, and he had better at once take the advice given to him by the company, and adopt a burner proper for the consumption of 16-candle gas.

Keighley, in Yorkshire, is not, under ordinary circumstances, a lively town, but a visitor to it a week ago to-day might have found an excited crowd in the market-place. If he stopped to listen to the oratory going on, he would have heard fierce denunciations of constituted authorities, and, if a timid man, he might have supposed a revolution imminent. Keighley enjoys the inestimable privilege of possessing a "Local Board of Health," and the visitor we have imagined would have heard them accused of "reckless extravagance." What, it may be asked, had they done? Had they, in imitation of the Common Council of the City of London, decided on giving themselves and their wives an expensive entertainment, and invited some royal personage to keep them in countenance? No; nor had they set up a sewage farm. They had merely proposed to raise the salary of their gas manager by the addition of the munificent sum of £35 per annum; hence all the hubbub and the noisy mob of ratepayers in the market-place. We are sorry for them, now rated, it seems, at 6s., which may soon be 7s. 6d., and eventually 10s. in the pound. But it seems to us that at Keighley, as at most places, the ratepayers are only hammering in the spigot, while they leave the bunghole open. If the gas manager is an intelligent man, he will, of course, take the earliest opportunity of clearing out of Keighley. His predecessor, it is said, is now receiving £450 a year at Dewsbury, and we hope Mr. Laycock may soon be able to do as well.

The Exeter Town Council make complaint against the gas company for creating a nuisance. The gas company say they are not to blame, and, at the same time, promise to remedy the matter complained of. If they have been using lime for 30 years, and complaints are now made for the first time, we can only imagine present carelessness on the part of the company, or greater fastidiousness on the part of the Exeter public. Lime purification does not necessarily involve the production of a nuisance. The Exeter Company, however, do well, under the circumstances, in resorting to oxide. It takes away the ground of complaint, and may, perhaps, benefit the company in a pecuniary sense. We have a suspicion that the Town Council have a hankering for the gas undertaking. If so, they might be candid, and say so. Peddling prosecutions for alleged nuisances are bad preludes to negotiations. With regard to the alterations which the mayor states that he wishes to see made in the Municipal Corporations (Borough Funds) Act, we, of course, do not know what Lord Aberdare intended to have done, nor what Mr. Cross will propose to do; but of one thing we are quite certain, and that is that Parliament will never allow a local authority to employ public money in competing with a gas company. The mayor of Exeter may rest assured on that point, and for the rest we hope to see that the Town Council and the gas company have arrived at an amicable understanding.

A Conservative contemporary, who writes very intelligently on gas matters, so forming a striking contrast to the bulk of the metropolitan political papers, yesterday threw out the hint that the best course the Legislature could take next year would be to pass a measure compelling the amalgamation of all the London companies into one. This, it is thought, will inevitably bring about that much-desired result—cheap gas, and still give the shareholders their statutory maximum dividends. We are sorry to differ; but if by cheap gas anything under 4s. per 1000 is meant, we can hardly see how the result is to be achieved. The saving which would be effected by "dislodging" a number of directors, and reducing the number of officials, would, after all, be small, and could only be realized at a distant date. Mr. Newton, who has opportunities of becoming well instructed in the various conditions of the gas industry, has been very well advised, when he, by implication, put the future price of gas in the metropolis at 4s. That is a price which we hope the largest companies will soon reach. How many years it may be maintained depends on circumstances respecting which we are hardly in a position to speculate. We are tired of repeating the opinion that gas coal will never again become so cheap as it has been, and, looking at

the amount of capital for which interest would have to be provided in case of amalgamation, we cannot see how gas can possibly be supplied for less than 4s. An allusion has been made before, in these columns, to a process known as "levelling up." In the case of general amalgamation, that process would probably make the comparatively poor consumers of the South Metropolitan district pay something in order that the City and West-end might be supplied with cheaper gas. The question is an extremely difficult one, and we may candidly admit that the only solution which has presented itself to our minds, up to this moment, is the purchase of the companies, or leaving things as they are, for time and circumstances to modify.

Dr. Whitmore, the medical officer and gas examiner for the parish of Marylebone, has issued his annual report, from which we gather that he considers the gas supply of his district as satisfactory on the whole. The illuminating power of the Chartered Company's gas did on one occasion fall a candle below the standard, but on another day it was nearly 2½ candles above, so that the vestry had nothing to complain of. The gas of the Imperial Company was on the average 2½ candles above the standard, "and on no single exception was the excess less than "1·11 candles." It is no business of ours, but we do not see the necessity for these reports, now that the Metropolitan Board test the gas, still it is satisfactory to have independent testimony to the quality of the gas supply.

Water and Sanitary Notes.

The report of Dr. Whitmore on the sanitary condition of Marylebone during the past year naturally brings up again the story of the production of typhoid fever by drinking milk brought from a farm at which a very doubtful case of typhoid had occurred. Doctors differ, and Dr. Hardwicke, the medical officer of the neighbouring parish of Paddington, has published a paper in which he expresses his disbelief in the story. Dr. Whitmore's answer is that his opponents have failed to advance any rational theory as to the cause of the outbreak, and therefore their opinions are not to be regarded. Surely a man may be permitted to doubt that the moon is made of green cheese without being required to state the exact composition of that planet. We see, in the report just issued by Mr. Simon, that Mr. Netten Radcliffe, who is seldom troubled with doubts, and never exhibits any want of confidence in his own opinions, reported to the Local Government Board that the outbreak *probably* arose from the distribution of milk. On another point Dr. Whitmore's report is more satisfactory. The water supply of the parish, furnished by the Grand Junction and West Middlesex Companies, is spoken of very favourably, as in general excellent in quality and abundant in quantity.

We may congratulate the country at large on the improved form of report issued by the medical officer of the Local Government Board. We have not now a somewhat bulky, and sometimes expensively got-up, volume, which few ever did, or could, read, and which only went to swell the mass of paper printed at public expense, which noble lords and members of Parliament dispose of to the waste-paper dealers at the rate of 15s. per cwt. we rather think. This is a modest document, costing 2d. We do not think the information it contains is worth the money. We do not, for example, appreciate the importance of knowing that Uttoxeter has five vaccination districts in the union, and that £3 5s. has been awarded in the past year for vaccinations under the inspection of Dr. Ballard; and we have a strong suspicion that the inspection cost more than the vaccinations. The introductory report, too, by Mr. Simon is rather vague even for that somewhat cloudy and verbose writer, and we hardly know what to expect in the future, but, with sound common sense at the head of the department, we may hope for the best. The object of the Medical Department for a quarter of a century to come should be to record *facts* when they can be discovered. At the present moment it is sheer impertinence to dogmatize.

The recent rainfall has enabled the Manchester Corporation to resume their full supply, but the necessity for the economical use of water still remains. At Blackburn, also, the past deficiency has been made up. At Liverpool the supply remains much as it was, the out-townships having mainly the advantage of a constant service. At Tunbridge Wells the supply has improved, but the commissioners still discontinue watering the streets. The Town Council of Huntingdon want water for their district, but they do not wish to see a private undertaking started, and they shirk the responsibility of advising a corporate scheme, so they do the most sensible thing, under the circumstances—call a public meeting to decide the matter. Great complaints are made in Carlisle of the insufficiency and bad management of the Corporation water supply. If the statements made at a meeting of the Town Council are to be relied on, the complaints are not altogether well founded; but even with these explanations it would appear that some alterations in the mode of distribution are advisable. A memorial of the committee of the Cumberland Infirmary sets forth that the water-works company always kept up an adequate supply, but that since the undertaking has been in the hands of the Corporation it has been wholly insufficient, and the Town Council pay no attention to the complaints made, and they pray for an inquiry by the Local Government Board. At Richmond, Surrey, it is reported that fish in abundance are still supplied by the Southwark and Vauxhall Company along with the water. The Local Board of Tottenham appear to have entered into negotiations with the New River and East London Water Companies for the supply of their district, being unwilling to incur the expense of further sources and more extensive machinery. There is also some talk of a local company to take over the works of the Board, but we fancy this is only talk. The best course the Board could adopt would be to fall in with the offers made by one or both the companies named—the district might be divided between the two—and then Tottenham would get an adequate supply of a much superior water.

The Leeds sewage works are now completed, and the Corporation, having got rid of the A. B. C. Company, have for a time handed over the works to a Mr. Goodall, who has been trying experiments which do not seem to have altogether satisfactory results. What the process he employs is we do not know. At Nuneaton great dissatisfaction is expressed at the results of the treatment of sewage by the General Sewage Manure Company (Anderson's process), and proceedings are threatened against the Local Board for polluting the river Anker. This may be a caution to Abingdon, the Town Council of which are just now being tempted to adopt the system of the company. We express no opinion as to the causes of the failure at Nuneaton.

There is another failure reported at West Bromwich, where the Towns Manure Company, working Mr. Manning's patents, we believe, entered into a contract with the commissioners, which has brought on the company a heavy loss. The secretary asks the commissioners for a grant of £800 a year to relieve the company of their difficulties. Out of all these failures good will eventually come. We are learning slowly, and the instruction is expensive, but the "sewage question" is in process of solution.

St. Helen's (Lancs.) Water Supply—Local Government Board Inquiry. Mr. J. T. Harrison, C.E., a commissioner from the Local Government Board, attended at St. Helen's on Thursday last, to inquire into an application from the Town Council for power to borrow £30,000 to complete the Whiston Water-Works. The existing powers, extending to £55,000, have been exhausted, and the further sum named is required. The application was opposed by Mr. Williams, on behalf of Captain Willis, of Halsnead Park, whose private supply has been drained; by occupiers of property in Whiston, who are in a similar position; and by the Prescot Union Rural Sanitary Authority, in the interests of the workhouse and township of Whiston supplies. Mr. Collins, solicitor, watched the proceedings for the Rainhill Gas and Water Company. All the parties were heard in support of their opposition, and then ruled out of court. Mr. Harrison told the Whiston gentlemen that they had no property in underground streams, and could not prove any loss or injury which gave them a *locus standi*. The sanitary authority having already made an agreement to take a supply for Whiston, including the workhouse, from the Rainhill Company, had no ground of objection. The opposition, therefore, was ineffectual. The £30,000 proposed to be borrowed is required for the following purposes:—£12,000 to complete the works, £7000 for necessary extensions thereafter, and £10,547 to repay money spent out of revenue.

Bath Water Supply—Local Government Board Inquiry.—In consequence of a petition from the Bath Corporation to the Local Government Board for a Provisional Order giving them increased borrowing powers for the completion of the water-works, and enabling them to extend the time for the payment of the funded debt, and to make the water-works debt chargeable to the borough fund, an inquiry was held at the Guildhall, on Tuesday, Aug. 4, before Mr. Robert Morgan, C.E., one of the inspectors of the board. The meeting consisted chiefly of members of the Town Council, and was presided over by the mayor. The inspector having been informed that the rateable value of the Urban Sanitary District of Bath is £253,021, and that the total present debt is £104,200, of which £70,000 was borrowed for the purposes of the water supply, thereupon read the notice convening the meeting, and invited discussion with reference to the petition of the corporation. The town-clerk said the fact which formed the basis of the petition presented was that the corporation had obtained powers of providing water-works and had rendered themselves liable for a larger amount of money than they were authorized to borrow under these Acts, the sum required to meet such liabilities being £14,000. The commissioner asked whether a larger sum would not be required for the completion of the works than was asked for in the petition, and was told that the council had merely applied for a sufficient sum to meet their present obligations, a large portion of the £14,000 having been already expended. Various gentlemen asked whether powers could not be granted, upon the result of the present inquiry, for borrowing a larger sum than that mentioned, so that various requirements of the city, including the purchase of various water-works, and the completion of those in hand, might be met. The necessity having been urged of improving in various ways the water supply, such as by an extension of the borough limits, to give the corporation power to buy the Charlcombe works, by purchasing several small companies works, and by providing adequate storeage for the benefit of houses on the higher levels, the commissioner expressed an opinion that the Town Council ought to be in possession of all available water; and it was resolved unanimously to request the commissioner to recommend that powers be granted for raising a sum of £7700 in addition to the £14,000 previously indicated, to enable the corporation to purchase the Circus, Rivers', Manvers', and Adams's Water-Works at a rental of 5 per cent on the purchase-money, with the option of purchasing, for sums which they could borrow at 4 per cent., thus saving one per cent., or £77 per annum, which would itself, at 4 per cent., liquidate the debt in about 40½ years. The proceedings terminated with a vote of thanks to the commissioner.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XXVI.

Retort Settings.

There are few subjects in connexion with gas lighting on which there exists so much diversity of opinion as on the mode of constructing and setting retorts. Happily the question as to the most suitable material for their formation has long been disposed of; but as to form and size, whether better of brick, or made in one or more pieces, and called for distinction clay retorts, remain matters of uncertainty.

The division of opinion in setting retorts, relates to the most suitable number to be placed in a bed and heated by one fire. In some large works the settings consist each of five retorts only, whilst at others double that number, and even twelve retorts, are set in one oven. There are also doubts as to the most economical manner of applying the heat, the formation and direction of the flues within the bed, and the construction of furnaces, &c.

Although the practical application and manufacture of clay retorts had their origin in Scotland, yet there is no other place where, if we may judge from the numerous kinds of retorts there adopted, the diversity of opinion referred to is so general; for, in that country, at several gas-works, brick retorts of varied shapes and dimensions are exclusively used, but, in the greater majority, they are of clay, sometimes cylindrical, as small as 14 inches in diameter, retained from the early years of their adoption, and increasing in size at other establishments to 20 inches diameter. The square form, rounded at the corners, also the oval, are preferred by some engineers; whilst the D shape, from the "squat" 27 by 13 inches, to other varying dimensions, the smallest being 15 by 13 inches, are very extensively used by different gas companies. It is somewhat surprising, when we remember the proverbially practical character of our northern friends, that greater unanimity in this respect does not exist, if only to effect a saving of labour, the more so as, from the nature of the coal carbonized, they are not influenced by considerations concerning the size of the coke produced.

The retorts generally used in England are either cylindrical, seldom less than 16 inches in diameter, the D shape, and oval, the former usually being 18 inches wide and the latter about 21 inches by 14 inches. On the Continent, the last two mentioned, with few exceptions, are almost universally employed.

As previously stated, in the earliest days of gas lighting the form of retort was supposed to influence materially the yield of gas from a given quantity of coal, and this opinion is still retained by some engineers. But, with the knowledge of the varied kinds of retorts which are in operation, and the intelligence generally displayed in the management of gas-works, we are led to the conclusion that the form, whether cylindrical or otherwise, has no appreciable influence in this respect, the yield of gas being dependent principally on the temperature to which the coal is submitted when undergoing carbonization. We see, indeed, in the best managed establishments, which differ only in the form of retorts employed, the same results practically, from the same kind of coal, are obtained, and at the Beckton works, where, a short time ago, cylindrical retorts were exclusively in operation, they have been replaced by others of the D form, without, however, producing any alteration in the yield of gas. It may be concluded, therefore, as before remarked, that the shape of a retort, considered by itself, has no influence upon the production of gas.

Having disposed of this question, we will now refer to the effects of the various kinds of retorts employed, the quantity of fuel they respectively require for carbonizing, the coke produced therefrom, their durability, and the labour in charging and drawing.

The object of a retort is simply to separate its contents from the surrounding atmosphere; and if it were made, as has been proposed, of thin platinum, then, as only the smallest possible obstruction would be offered to the conduction of the heat to the coal undergoing carbonization, perfection in this respect would be attained. But there are difficulties of expense, and other considerations, which render this impracticable.

Following out this theory, we should imagine that fire-clay retorts ought to be made as thin as possible, consistent with security from breakage in transport and when in operation, and that any unnecessary thickness of material therein, or any obstruction to the free conduction of the heat as generated to their interior, either by slabs or walls abutting against the retorts, must demand extra fuel for carbonization, and be prejudicial to economical operations. In practice, however, these considerations are very often disregarded, for, as stated, there are gas-works where brick retorts, having nearly double the thickness of those of clay, are exclusively adopted. Again, there are other works where transverse walls, often 9 inches thick, are placed within the oven at intervals of about a foot, abutting on and surrounding the retorts, so that little more than one-half of their surface is exposed to the direct action of the heat.

Objections to these alleged defects have been frequently made, and met by the answer "that a setting so constructed, when once heated to the desired temperature, requires no more fuel for carbonizing than another having thin retorts, and in which the extra non-conducting material is dispensed with." Nor is this opinion confined to engineers of this country, for we find the same views expressed by Dr. Schilling, in his admirable "Traité d'Eclairage par le Gaz." In reference to the sustaining walls of retorts, he says, "I cannot admit that this consolidation of retorts incurs any greater consumption of fuel. As the service is continuous, it appears to me quite indifferent whether a larger or smaller quantity of bricks has to be heated; the only advantages that would be attained by the absence of these sustaining bricks are the economy of their cost, and the labour in placing them, which are insignificant when compared to the durability of the retort."

There are, however, other engineers who follow a directly opposite system, and use retorts not exceeding 2½ or 2¾ inches in thickness, placing them simply with proper intermediate supports, only protected by slabs in the immediate vicinity of the furnace, or furnished with the necessary division walls for flues, and without any superfluous non-conducting material. Of course, under these conditions, only retorts of the quality we before alluded to—that are neither liable to break nor crack by the action of the fire—can be used; and according to our practical experience this method of setting retorts is, beyond question, advantageous for economy in setting, and more particularly for the saving effected in the fuel for carbonizing. With the view of substantiating our opinion, we will enter into a few statements, from which the reader may judge of the correctness of our observations.

Beyond all question, the laws relating to the conduction of heat, whether for the production of steam or for the decomposition of coal, are identically alike; in both cases the heat being conducted or transmitted with the greatest facility, where there exists the least obstruction, whether this obstruction arises from the nature of the intervening material, or its thickness. These principles are well understood, and taken advantage of by mechanical engineers in the construction of steam-boilers, surface condensers, and such like apparatus, and in the prevention of loss of heat by radiation, to which we shall presently refer.

Prior to the general adoption of clay retorts, the most forcible argument against their use, and one which was advanced with perfect reason, was founded on the nature of the material of which they are formed, being, as it is, amongst the chief non-conductors of heat. This admitted, it is evident that any excess thereof, either in the formation of the retorts, or in the parts immediately adjoining them, must be prejudicial to economical working.

Following our arguments, with the view of demonstrating the erroneous opinions respecting thick retorts, and the presence of non-conducting material in their ovens, let us imagine a steam-boiler, which, when perfectly clean in the interior, and charged with a certain quantity of water, and a given quantity of fuel, would produce steam of a certain pressure in a defined period—say one hour. In the course of time, by the accumulation of incrustation derived from the water employed, the same boiler, under similar conditions and for the same purpose, would require two hours and double the quantity of fuel, after which the action would be continuous. The first condition is precisely that of setting thin retorts, with no superfluous non-conducting material, the second being directly the reverse. The supporters of thick retorts would conclude that if once steam were generated, or once the retorts were brought to the desired temperature, the action being continuous, no extra fuel from that period would be required. But theory and every-day practice prove incontestably the very opposite, and show that any non-conducting material, either as a coating within the boiler or as a shield on its exterior, occasions a continual excess of fuel absolutely necessary to produce the required quantity of steam.

If the theory were correct that a non-conducting body, once being, as it were, saturated with heat, then ceased to be a non-conductor (for this is the proposition of the supporters of thick retorts and excess of brickwork), it would be speedily adopted by marine boiler manufacturers to protect their huge and costly vessels from the action of the fire, to which, sometimes, they are subjected for weeks together. But their principal consideration is economy in fuel, and as the cost of this, in some of our merchant steamers, amounts to upwards of £100 per diem, all known means are adopted to secure that object, and the absence of non-conducting material is one of the most important of them.

Again, in the construction of steam-boilers the extent of surface exposed to the action of the heat is of the first consideration. If this be diminished, so will be the effects of the fuel in a corresponding manner, the result being that a portion of the heat generated, which would have been absorbed by the larger surface, is permitted to pass off uselessly into the atmosphere. In the same manner, in our opinion, when the surfaces of retorts are embedded in non-conducting material, the same results take place.

Lastly, to carry the comparison still further, in the construction of locomotive boilers, where the action of the heat is required to be the most effective and rapid, not only is the extent of surface a consideration, but the nature of the material composing the tubes, which are made as thin as possible, compatible with safety and durability, so as to present the minimum obstacle to the transmission of the heat.

From these considerations, therefore, we may conclude that, in order to obtain economy in fuel for carbonizing, the existence of any unnecessary thickness of material should be avoided, and that, for the free conduction of the caloric to the interior of retorts, their surfaces, so far as practicable, should be exposed to the direct action thereof. If these views are correct, it is clear that brick retorts, having a thickness so much greater than those of clay, or any superfluous brickwork within the setting, and more particularly as walls abutting on the retorts, are highly prejudicial to successful operation. We have the strongest conviction that if the cause of the extraordinary consumption of fuel for carbonizing at some gas-works were inquired into, it would be found to arise from one or both of these defects.

We are happy to say that the views we have here expressed are supported by the successful operations of many engineers, the com-

pany represented by one of these, where the system recommended is rigidly carried out, having shown the most favourable balance-sheet that has perhaps ever appeared in the JOURNAL OF GAS LIGHTING—a result which must be acknowledged to be the best criterion of successful operations.

The most desirable kind of retort for the production of coke, having reference to its sale as a residuum, must be decided by circumstances; for, in localities where the demand exists for large coke, in foundries, railways, &c., retorts of increased capacity should be adopted, having a width of 24 or 27 inches, and for this purpose the D shape, rounded at the corners, or the oval, may be beneficially used.

Under ordinary conditions, retorts of less width are more suitable, as they can be made thinner than the former, thus offering advantages in the fuel account; but, whether D or oval, there is little difference in their results, the latter, however, offer greater facilities in drawing the coke, as it leaves more readily than with the D shape. In cylindrical retorts especially, when of small diameter, the coke at the edges is thinner and, of course, smaller, which is a disadvantage.

With regard to durability, brick retorts, built with care, are more lasting than those of clay; but any economy obtained on this score is always more than counterbalanced by the cost of construction and the great quantity of fuel they require for carbonizing. Moreover, after two years or two and a half years service, the fire-place of the furnaces becomes enlarged by the wear and tear of continuous working, so as to require a large per centage of fuel to heat the retorts. Durability is, therefore, not always an economy.

In the form, but more particularly in the size of retorts, labour becomes an important consideration, and in this respect those of small diameter and length must always involve more work in charging and discharging, for a given quantity of coal carbonized, than those of larger capacity. All the extra labour with the one operation of the large retort, consists only in the extra quantities of coke withdrawn, and the coal placed therein. With small retorts, therefore, the labour of charging and discharging must always be greater than in the larger.

Our conclusions on this subject may, therefore, be summed up in the following terms:—That, for the economical production of gas, its quantity or quality is not affected by the form of the retort.

That, for economy in fuel, clay retorts present great advantages over those of brick, and that they should be set with as little extra non-conducting material as possible.

That for durability the brick retort is superior, however, but that no economy can be obtained from its use; on the contrary, whatever is gained on this head is lost in the extra fuel required for carbonizing.

That the labour in charging and drawing retorts is always relatively greater when those of small dimensions are employed, and diminished as they increase in size. There is, however, every reason to believe that this, the most trying of all manual labour, will, in the course of a few years, be effected by machinery—at least in large and medium-sized works; and when we observe the numerous applications of mechanical power to various useful purposes, it will not be very creditable to the intelligence of gas engineers if the manual labour, now necessary for charging and drawing retorts, is not superseded by motive power; and, as experience has always demonstrated, wherever machinery supersedes manual labour, it is to the advancement of civilization, and to the profit of those immediately interested.

(*To be continued.*)

STOCKTON AND MIDDLESBOROUGH WATER-WORKS COMPANY.—At the half-yearly general meeting, at Darlington, on the 4th inst.—Mr. H. Pease in the chair—the accounts showed an available balance of £12,237 0s. 9d. After payment of all fixed charges, placing the sum of £200 to reserve-fund, which then amounted to £5000, dividends had been declared on the original and A shares, at the rate of 12s. 6d. per share; on the B and D shares paid up, at the rate of 10s. per share; and on the D shares (third issue), at the rate of 8s. 2d. per share; also £1 per share towards the arrears on the original and A shares; payable at the National Provincial Bank of England, Darlington, on Friday, Aug. 7, 1874. Although the unfortunate strike of the miners had temporarily lessened the pressure upon the company in respect of new developments requiring water, yet the directors, mindful of the important position the company held in the district, were of opinion that the time had arrived when they must ask the proprietors sanction to apply to Parliament for increased powers, both financial and constructive, the matured views of the engineer having first been obtained. The statement of income showed a total revenue for the half year from water-rents of £17,702 16s., and from water-meter hire of £442 10s. 7d. The chairman said the directors were advised by the engineer to apply to Parliament for increased powers. The district chiefly under their consideration was that lying between Middlesborough and Redcar. The development of their business there was going on satisfactorily, but circumstances did not warrant any longer delay in obtaining sufficient powers to supply that district. Although their mains had been ample during the last half year, yet their requirements were such that they ought to have more pumping power in proportion to the demand. They thought, when they erected their last engine, that they surely were beforehand with their requirements, but, happily, the district had advanced at a more rapid rate than their anticipations then shadowed forth. The auditor's report, he was happy to say, showed an available balance of £12,237 0s. 9d. exclusive of the reserve-fund, amounting to £4800. He moved the adoption of the report and the statement of accounts. Mr. Allison seconded the proposition. The chairman, in reply to Mr. Grace, said they had still a considerable margin for the extension of their supply under the Act, and it would not yet be necessary for them to make any catchwater supply. The extension of the works was a matter which gave them great concern. They had, however, a promise from Mr. Hawksley that he would come down and report on the proposed extension within the next fortnight. Mr. Bowman said that from the formation of their company the expediency of taking the water from a point further up the Tees had been suggested, and there was some idea of bringing it from Cauldron Snout, amongst the Moors in Upper Teesdale. It did not appear, however, to be feasible, taking all things into consideration. The motion was then put and carried, and the directors were authorized to apply to Parliament next session for an Act or Acts to enable the company to raise further capital and to extend their works.

Communicated Articles.

THE PRINCIPLE OF THE VALUATION OF GAS COAL.

By D. A. GRAHAM, Stalybridge.

(*Continued from p. 79.*)

Arithmetical Methods of Finding the Value of the Return per Ton, and the per Centage of Coal and Cannel required to Produce any Quality of Gas Intermediate to the Values of the Particular Coal and Cannel selected to Produce that particular Quality of Gas.

In the last chapter, we described a graphic method of obtaining the values of the returns per ton, and the illuminating power of the gas produced from mixtures of any particular coal and cannel. In this paper we purpose to describe a method of finding the value of the return per ton, corresponding to the illuminating power produced from mixing such per centages of that coal and cannel as shall produce that particular intermediate quality of light; and we shall also show how the values of these per centages may conveniently be obtained.

Thus: Let it be required to manufacture 18-candle gas from a mixture of the coal and cannel quoted in the last chapter.—The coal was one which produced 9000 cubic feet of 12-candle gas, and the cannel produced 10,000 cubic feet of 22-candle gas; and the following formulæ would give expression to the values required to be ascertained:

$$(9000 \times 12 \text{ candles} \times x) + (10{,}000 \times 22 \text{ candles} \times y) = 100 \times 18 \text{ candles} \times z,$$

$$\text{or } 108\,x + 220\,y = 1800\,z.$$

Where x would equal the per centage of coal, and y the per centage of cannel requisite to make up 100 per cent. of the particular quality of gas required, which per centages would produce a return per ton corresponding to the value of z.

Or the value of x might be expressed in terms of y, for

$$x = 100 - y \therefore (108)\ 100 - y + 220\,y = 1800\,z.$$

Now the value of y may be easily found as follows, and from it the values of both x and z may readily be found; for $100 - y = x$, and z will equal the left-hand term of the equation divided by 1800, a number corresponding to all these values reduced to their lowest terms:—

Now 18 candles − 12 ⨯ 4, and 4 × 12 = 48
18 candles − 22 ⨯ 6, and 6 × 22 = 132

And 10)180 = 18

So that a mixture of 4 feet, or any multiple of 4, of 12-candle gas, *plus* 6 feet, or the same multiple, of 22-candle gas, will produce 18-candle gas.

Now, 4-9ths of a ton of coal producing 9000 cubic feet, *plus* 6-10ths of a ton of cannel producing 10,000 cubic feet of 22-candle gas, would together produce 18-candle gas.

$$\text{And } \frac{4}{9} + \frac{6}{10} = \frac{40}{90} + \frac{54}{90} = \frac{94}{90} \text{ of a ton of these two qualities of}$$

coal requisite to produce this particular quality of gas.

And 94 : 100 :: 40 : 42·55
And 100 — 42·55 = 57·45

Together = 100·00 per cent.

Therefore, 42·55 per cent. of this coal, *plus* 57·45 per cent. of this cannel, will produce 18-candle gas.

For 12 × 9 = 108, and 108 × 42·55 = 4,595·4
And 22 × 10 = 220, and 220 × 57·45 = 12,639·0

Together = 17,234·0

$$\text{And } \frac{17{,}234{\cdot}4}{18 \text{ candles}} = 9574 \text{ cubic feet.}$$

And 42·55 × 9 = 382·95
57·45 × 10 = 574·50

957·25 cubic feet.

Which value of y will also be found to correspond to the values which might have been obtained by construction.—For example, let it be required to find the per centages of coal and cannel requisite to produce 15·3-candle gas from a mixture of a coal producing 10,665 cubic feet of 14·3-candle gas, and a cannel producing 9676 cubic feet of 20·3-candle gas (see figure on next page)—

15·3 − 14·3 = 1, and 1 × 20·3 = 20·3
15·3 − 20·3 = 5, and 5 × 14·3 = 71·5

6 91·8

$$\text{And } \frac{91{\cdot}8}{6} = 15{\cdot}3 \text{ candles.}$$

Now, the quantity of coal and cannel requisite to produce this quality of gas will be found as follows:—

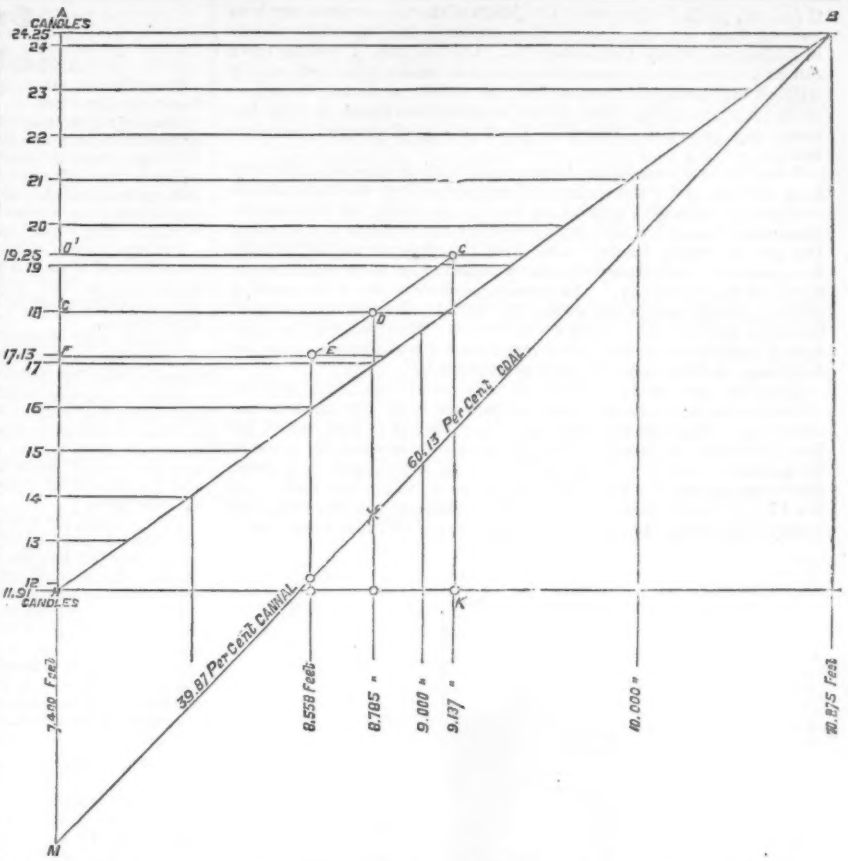
$\frac{1}{9676}$ of cannel + $\frac{5}{10{,}665}$ of a ton of coal would produce 15·3-candle gas.

$$\text{And } \frac{1}{9676} + \frac{5}{10{,}665} = \frac{10{,}665}{103{,}194{,}540} + \frac{48{,}380}{103{,}194{,}540}$$

And 10,665 + 48,380 = 59,045
And 59,045 : 100 :: 10,665 : x ∴ x = 18·06
And 100 − 18·06 = 81·94
∴ 81·94 × 10,665 = 8738·9 cubic feet,
And 18·06 × 9,676 = 1747·48 ,,

So that the mixture will produce 10,486·38 cubic feet—a result

(10,486) which nearly corresponds to that obtained from measurement; so that this method of obtaining these results may be reduced to the following rule:—Find the difference between the value of the illuminating power produced by the coal, and the quality required to be produced, and find the same value for the cannel. State this difference of value for the coal opposite the value of the illuminating power of the cannel, and the difference for the value of the cannel opposite to the value of the illuminating power of the coal; these two numbers will represent the numerators of fractions whose denominators are the values of the returns per ton the coal and cannel will produce, the returns per ton, representing the denominators of these fractions, being placed under these crossed numerators, but opposite to the illuminating power corresponding to these returns per ton. Reduce these two fractions to their least common measure, after bringing the fractions to a common denominator; add their numerators; then will their sum be to one of them as 100 is to x, and $100-x$ will give the other value, y; from which per centages the value of the return per ton may easily be obtained by multiplying these numbers by the return per ton of each, and adding the results for their common return per ton.*



We shall finish this chapter by illustrating this rule with another example, one of whose terms represents the returns per ton of a coal raised in the Manchester district, and known as G——s's. It was highly recommended by a coal dealer who was employed to sell it, and we know of some companies who have had a somewhat painful experience of its good qualities.

This coal produced 7400 cubic feet of 11·91-candle gas, new London burner, and the cannel produced 10,875 cubic feet of 24·25-candle gas. Now, let it be required to make 18-candle gas from a mixture of this coal and cannel, what will be the per centages of each required, and what will be the value of the return per ton?

$$18 - \begin{matrix} 24{\cdot}25 \\ 11{\cdot}91 \end{matrix} \times \begin{matrix} 6{\cdot}09 \\ 6{\cdot}25 \end{matrix}$$

So that 6·09, or any multiple of 6·09 cubic feet of 24·25-candle gas, *plus* 6·25, or the same multiple of 6·25, will produce 18-candle gas. Now, the quantity will be expressed by the following fractions.

$$\frac{609}{10{,}875} + \frac{625}{7400} = \frac{4506600}{80475000} + \frac{6796875}{80475000}$$

And $4506600 + 6796875 = 11303475$

And $11303475 : 100 :: 4506600 : x \therefore x = 39{\cdot}87$

And $100 - 39{\cdot}87 = 60{\cdot}13$.

So that 39·87 per cent. of this cannel,
plus 60·13 per cent. of this coal, will make 18-candle gas.

100·00	
Now 39·87 × 10,875 =	43358625
And 60·13 × 7,400 =	44496200
100·00	8785

So that this mixture will produce 8785 cubic feet.

Now this coal, sold for 14s., delivered, when the coal which produced 10,665 cubic feet of 14·3-candle gas was selling at 20s., delivered; but we shall defer an examination into its real value for future consideration.

On reference to fig. No. 2. in a former chapter, the *rationale* on which this rule for finding the return per ton, and the per centages of coal and cannel requisite to produce a particular intermediate quality of gas, has been founded, will be apparent; this rule being an adaptation of the rule given in some works on arithmetic, and known as Alligation, but, as far as we are aware, it has not hitherto been applied to mixtures of coal and cannel with a view to find out the return per ton they will produce, or the per centage of either required to be used to produce any particular intermediate illuminating power, but it will be found to agree exactly with the results obtained by other and constructive methods, and has been deduced from a consideration of the nature and properties of the diagram.

(To be continued.)

LEAKAGE.

By SHADRACH STUDHOLME, Whitehaven.

In Nos. 548 and 563 of this JOURNAL, Mr. Methven gave the plan and results of the testing of the mains of a gas company under his care; and as I have for some time been testing and repairing the mains of this company during the summer months, it may corroborate his statements, and, if needed, give weight to his remarks, if I add my experience, and also show the plan I adopt for testing for leakage, such plan having special reference to the way in which the portable gasholder is filled with gas.

Some time ago our leakage was what I considered very great, caused principally, I believe, by the sewering of the town; and of necessity we began to examine the mains and services. This was done by cutting the main, and attaching a gas-meter, as shown in No. 548 of your paper, and then stripping the mains and services. Last year we again began examining and testing on the same plan.

For testing this year, I have a small portable gasholder, about 22 inches diameter by 25 inches high, with pipes, handles, tap, &c.; and by using a pair of cylindrical bellows, which I adapted for the purpose, after the gas-main is cut and the connecting-pipe, with taps 1, 2, 3, attached (see sketch), I can take the gas out of the main, in which there is only the ordinary day pressure, and force it into the gasholder, which can be weighted to give any pressure that is needed.

If the gasholder be filled with gas, the tap, E, on the outlet, may be opened, when the gas will pass through the gas-meter into the main under examination. By using the bellows the gasholder at any instant can be supplied with gas, and the observation for leakage taken any minute. If the gasholder be filled, as is usually done, without the bellows, by the gas from the main with the day pressure, the weights must be removed, or the gasholder to rise must be assisted by hand, and the tap, E, between the outlet of the gasholder and gas-meter, must be shut; and so, when the test is to be again applied, the gasholder is to be weighted and the tap opened.

By keeping the supply of gas in the holder by the bellows, I can,

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* The following formulæ will give expression to the above method of computing the values of the per centages and the return per ton a mixture of these per centages will produce.

Let A equal the intermediate value of the gas it is desirable to produce, B the value of the quality of the gas produced from the coal, and C the value of the quality of the gas produced from the cannel.

$$A - B \times d$$
$$\text{And let } C - A \times c$$

Further, let the production per ton of the coal producing a light equal to B = F, and the production per ton of the cannel producing an illuminating power equal to c = H.

Then will $\frac{d}{F} + \frac{c}{H}$ = the sum of the values of the proportions of the mixtures of the coal and cannel requisite to produce that particular quality o gas (A).

$$\text{Now } \frac{d}{F} + \frac{c}{H} = \frac{d\,H}{F\,H} + \frac{c\,F}{F\,H}$$

and $(d\,H) + (c\,F)$ will equal the sum of these two numerators;

and $(d\,H) + (c\,F) : 100 :: d\,H : x$;

$(d\,H)$ being the value of the numerator for the coal, and x the value of the per centage of coal required.

Or, $(d\,H) + (c\,F) : 100 : c\,F : y$,

$(c\,F)$ being the value of the numerator of the fraction of the cannel required, and y the value of that per centage, and $100 - y$ or $100 - x$ will give the value of the other per centage required.

And x into the return per ton the coal will produce, *plus* y, or $(100 - x)$ into the return per ton the cannel will produce, will give the return per ton the mixture will produce.

From this rule another could easily be deduced, giving the value of the production per ton and the illuminating power a coal or cannel will produce, from the value of these returns in the mixture one of the values for the coal or cannel being known; but we shall not at present advert to this matter, leaving it to be treated of in another chapter.

if desired, prick the ground at the joints of the main or over services; and as there are, say, 3 or 4 inches pressure, this materially assists in finding out where the leakage is. On this plan of testing there can be 3 or 6 inches of pressure on the main under examination only without increasing the pressure from the works; so that on the whole of the district, except that under examination, there is only the usual day pressure. This is a great saving of gas and therefore money.

I find it is very useful to have a small testing gas-meter for very long services. After the service is disconnected from the main, attach one end of the flexible tube to the bend in the main, the other end to the inlet of the meter, and from the outlet of the meter to the end of the service attach another tube; keep the pressure on the main by the gasholder, and observe the meter, which will show whether the service is tight or leaky. This, in some instances, saves the opening of the ground, and is otherwise very useful. I could give several instances where, with a 4-inch pressure, we have reduced the leakage of from 30 to 50 feet per hour to from 3 to 5 feet per hour per 100 yards of main, with all services connected.

I have a very strong opinion on one point—viz., that any one wishing to reduce leakage to a small amount must not trust to the stripping of mains and services alone, but that if a good sound job has to be made, he must use the gas-meter test, as when the pressure is applied it will show if the main, &c., be sound, and is a great deal more satisfactory than stripping without using the meter. It is a kind of work that requires time, patience, perseverance, and money; but money so spent is well laid out, and will soon repay itself.

The accompanying sketch, in which can be seen the gas-main with the connecting test-pipe attached, will show the testing apparatus in a very clear manner. A is the cylindrical bellows, with handle, lever, and inlet and outlet pipe, on the latter of which is fixed a half-inch tap, B, which can be shut during the time of observing the test, and also prevents any gas passing from the holder through the bellows and back into the main. When the gasholder is to be filled again, open the tap B and work the handle of the bellows. The gasholder will then rise, not in a jerking manner, but regularly, the action of the bellows being very steady and even. This plan, being so ready of application and constant in its supply, admits of a very small gasholder being used, even where there is a heavy leakage; or when a few hundred yards of main are being tested, the observation can be taken while the holder is being supplied, and is a much more ready way of filling the gasholder with gas than by the main with the day pressure, as no weights have to be taken off the holder.

C is the gasholder, provided with guide-rod, pulleys, weights, and a handle on each side for lifting from one place to another; the pressure can be adjusted to any required amount by the weights. D is a small tap on the holder to let all or any portion of the water out, and lighten it for removal. E is a tap between the holder and gas-meter, which, on being shut during the time any connexion is being made between the services and the main, keeps the gas in the holder. F is the pressure-gauge, and G the gas-meter. The apparatus is connected in a very few minutes by a flexible tube.

EPWORTH GAS COMPANY.—At the annual meeting of this company just held a dividend of 5 per cent. was declared, and it was decided to reduce the price of gas 5d. per 1000 feet—namely, from 7s. 1d. to 6s. 8d., which was the price per 1000 feet before the rise in the price of coal took place.

Correspondence.

ANDERSON'S GAS PURIFICATION.

SIR,—Permit me to correct a trifling error which I find in the report I sent you last week.

The aggregate sulphur (in other forms than sulphuretted hydrogen) in the six experiments should have been stated as 69·4, and the mean as 11·57 grains per 100 feet of gas, and not 10·06, as stated.

Hence the difference between 11·57 grains thus obtained by the referees test and the 12·50 grains obtained by mere evaporation of the liquid formed by combustion, and estimated from the sulphate of ammonia formed, is only 8 per cent.

Perhaps some of our London friends, who are making these tests daily, can tell us whether this per centage of difference between the two modes holds good in their experience, or what they find it to be, and what objection there would be to performing the experiment in the latter more simple mode.

I relish your satirical suggestion as to the responsibility I incur in washing out sulphur, which, if burnt, would be "converted into such a valuable health-preserving and curative agent."

When the public becomes "educated" to think so, I may consider the point; but as at present they do not, and I find it puts money in my pocket to "make concessions to popular ignorance," I am not inclined to set up as martyr to mere truth. Joking aside, I have seriously contradicted a prevalent notion as to the evil effects of "a little sulphur in the air," and I still wait for some one who will take up the other side and sign his own name.

This sulphur cry reminds me of the homœopathic cure for dyspepsia. You dissolve one globule of the medicine in a gallon of water; one drop of this you put into the Thames at Battersea Bridge, then walk down to London Bridge and drink a glassful of the water there. Repeat this every morning before breakfast till you recover your digestion.

People who recover under this regimen may attribute their success to their exercise; people who become ill will find it difficult to bring it home to such a homœopathic dose of sulphurous acid as is to be found even in the air of a manufacturing town, where thousands of tons of coal are burnt, and all the sulphurous acid produced delivered into the air without either washing, scrubbing, or purification.

4, *Cannon Row, S.W.* GEORGE ANDERSON.

MR. WINSOR'S CLAIM TO ORIGINALITY IN THE APPLICATION OF COAL GAS.

SIR,—As little facts connected with the early history of gas lighting are generally interesting, perhaps the following may be worthy of insertion in your JOURNAL.

An article appeared in *Nicholson's Philosophical and Scientific Monthly*, on Jan. 1, 1807, in opposition to Winsor's proposed National Light and Heat Company, in which it was maintained that there was no novelty in the application of coal gas, and the experiments of Drs. Clayton and Watson, also the practical application of Murdoch, were referred to. These were followed by various observations, showing the difficulty of obtaining an Act of Parliament, the law of partnership, &c., all unfavourable to the projected company.

In reply to this, Winsor issued a pamphlet, the concluding remarks in which are as follows:—

"It is a pity that neither myself, the bankers, or any of the numerous subscribers ever thought of applying to Mr. Nicholson for rules of conduct in our business. Perhaps Mr. N. will avail himself of the opportunity of our next general meeting to convey his further instructions."

"I repeat that *raw gas-lights* have been known centuries ago, and I wish Mr. N. no worse employment than to catch and collect such lights as he here describes, for the use and benefit of the realm, in order to supersede the *National Light and Heat Company*. Mr. Nicholson having thrown the gauntlet of irony (in imitation of some jokes on the word smoke-lights), by calling my plan 'Gaseous Proposals for Enlightening the Inhabitants of London,' he cannot take it amiss that ironical expressions are returned in defence.

"I can but congratulate Messrs. Nicholson and Co., &c., &c., of the further and happy discovery of the primogeniture and genealogy of some 'Will-o'-the-Wisp Lights,' or 'Ignis Fatuus,' vulgarly called 'Jack-in-the-Lantern Lights,' by the late Rev. James Clayton, and I hope, by their united perseverance and ingenuity, they will soon be able to catch plenty of gas, issuing from the fissures near coal pits, and to collect the 'phlegm, black oyle, and inflammable spirit,' and then by pricking plenty of holes in their bladders, they may amuse all their learned friends and correspondents, and perhaps be able to supersede the gaseous proposals for a National Light and Heat Company.

"It may, perhaps, be deemed unfortunate by Mr. N. and his friends that my discovery is not brought forward under the patronage of some dignified member of an academy or scientific institution, but by a mere stranger, trusting, like Saul, unto the sphere of prophets."

17, *Burton Road, Brixton Road, Aug.* 14, 1874. W. RICHARDS.

SOME MODERN APPLIANCES IN GAS-WORKS.

SIR,—I perceive by your number before last that, in the course of the conversation concerning the dip-pipe question at the meeting of the North British Association of Gas Managers, Mr. Alexander very wisely remarked, "How, in such case, I would ask, is the pipe to be sealed during the repairs required by such derangement? It is in gas engineering as in military tactics, well to keep an eye on a good retreat," referring to those contrivances which, if out of repair, are quite beyond the control of any one, simply because they were enclosed within the hydraulic main.

Mr. Whimster also discusses the probability of some arrangements becoming unsound, and gives as his opinion preference to a liquid joint, which must decidedly be the best to be trusted.

My object in writing you is simply to express my opinion—viz., that there is but one invention which obviates the difficulties proposed by the above-quoted gentlemen. The contrivance to which I allude is a liquid joint, and has been in operation now for 12 consecutive months, and is still working without the least indication of the tar in the hydraulic cup becoming thick, which probably is accounted for by the fact of there being a continuous supply of fresh tar—produced by carbonization—and, therefore, a constant displacement into the hydraulic.

Notwithstanding I am of Mr. Hislop's opinion, that if it were necessary to clean out any appliance once a year, it would be but a very small matter. I find this apparatus is entirely under control, and also easy of access, should circumstances necessitate; because, by simply taking off the flange on top of the H-pipe, we are at once enabled to remove the dip, without any interference with the hydraulic main; or should the rod break, as suggested, the dip is immediately immersed in the liquid in the hydraulic, and is at once as an ordinary dip-pipe. I may state that I have not experienced the slightest inconvenience or difficulty with the stuffing-boxes, which work perfectly easy and gas-tight. I am so satisfied with the ease and safety of this apparatus that I scarcely think we need clamour for automation.

J. C. C.

London, Aug. 5, 1874.

THE COST OF GAS IN BIRMINGHAM.

SIR,—No reply has appeared to my letter to you of July 31, but I have before me a copy of the *Engineer* for July 17, which contains a report of Mr. Foulis's speech. He is there reported to have said, after quoting Dr. Wallace, that "if the same quality of gas were supplied *in Glasgow as is supplied* in Birmingham, and sold at 2s. 3d. instead of 4s., it would cost the inhabitants £250,000 per annum more than they now pay for the same amount of light." The words in italics, which appear necessary in order to render the sentence intelligible, were omitted in your report.

If this conclusion be correct, Glasgow is to be congratulated; but I do not think Mr. Foulis has sufficiently realized the full meaning of his words, for, in effect, it is as much as to say that 1 foot of 27-candle gas is equal to 3¼ feet of 15. This is easily seen. The rental, at 4s., is stated by Dr. Wallace to be £252,000, which would represent a consumption of 1260 millions. Add to this amount the £250,000 which, according to Mr. Foulis, would be required if 15-candle gas, at 2s. 3d., were substituted, and divide by 2s. 3d., and we get

$$\frac{£252{,}000 + £250{,}000}{2s.\ 3d.} = 4462 \text{ millions},$$

or three and a half times the above.

If any refutation were needed of a proposition so clearly erroneous, it is supplied by Mr. Foulis himself. He says, with Dr. Wallace, that the average illuminating power of their 27-candle gas at the consumer's burners is not more than 16 candles. Now, supposing ours to be reduced from the same causes to 10 candles—I am sure the average is considerably higher, but I wish to be well within the mark—then,

As 10 candles : 16 candles : : 2s. 3d. : 3s. 7·2d.,

which is the value to the consumer of 27-candle gas, as against 4s. actually charged. In other words, were the consumer served with the cheaper gas, he would get for 3s. 7·2d. the same amount of light which costs him in Glasgow 4s. Clearly, then, so far from being losers, the inhabitants of Glasgow would be great gainers by such a change.

Birmingham, Aug. 15, 1874. CHARLES HUNT.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

LAMBETH VESTRY.

At the Meeting of the Vestry on Thursday last—Mr. BUERUP in the chair—a report was presented from the Lighting Committee, which stated that according to Dr. M'Cormack's examinations, the illuminating power of the gas supplied by the Phœnix Company during the past month was 14·91 candles, and by the London Company 15·26. The committee recommended the vestry to give their assent and support to the proposed bill of the Metropolitan Board for power to furnish an independent supply of gas to the metropolis.

The adoption of the report having been duly moved,

Mr. P. WELLS moved as an amendment that the last paragraph be left out. He contended that the only way to effect a remedy was to bring a pressure upon the House of Commons. He would recommend the Metropolitan Board of Works to stick to the sewers. When Apelles called the Athenians to witness his works of art, a son of Crispin was among them, and he attempted to give his opinion, which excited the laughter of the rest. *Ne sutor ultra crepidam:* let the shoemaker stick to his last. That was what the Metropolitan Board of Works should do. They should stick to the sewers and the Embankment, and nothing else. He believed that the children of the present ratepayers would learn with sorrow of the powers exercised by the Metropolitan Board. He referred to the half million of money for the purchase of Northumberland House, which he said was a waste of money for an outlet which they could have obtained at a considerably lower rate. He believed the new street would remain a gigantic monument of the folly of the board.

The amendment having been seconded,

Mr. C. M. BARKER observed that the House of Commons would not legislate for one parish, but the whole of the metropolis. Having explained the difficulties which small companies would have to contend against in obtaining a bill for the manufacture of gas,

Mr. P. HART thought the recommendation of the Lighting Committee was a very good one.

Mr. F. H. FOWLER said the real object of the Metropolitan Board was to go to Parliament in order that some pressure might be brought about to obtain a reduction in the price of gas. As to the Metropolitan Board taking upon itself more work, he could positively state that such was not the feeling of the board. They did not at all wish, in addition to the large amount of work they already had on hand, anything further in the shape of the manufacture of gas. He was of opinion that good would be effected by the Metropolitan Board of Works, supported by the corporation of the City of London taking up the question.

Mr. BENNETT observed that the committee were unanimous that the best course would be to leave the matter in the hands of the Metropolitan Board of Works.

The amendment, on being put to the vote, was lost, and the report was adopted.

METROPOLIS WATER SUPPLY.

Major Bolton's report for the month of July states that the condition of the river at Hampton, Molesey, and Sunbury, where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, and East London Companies are situated, was very good from the 1st to the 7th, when it still improved, and became clear and bright, in which condition it remained until the end of the month. The highest flood state of the river at Hampton during the month was 1 inch above the (6 feet) summer level, and the lowest 4 inches below. At Ditton the state of the water in the river during the month was good for 25 days, and indifferent for 6 days. The Chelsea Company is now the only one whose intake is below Hampton Court bridge. The highest state of the flood water at this place was 4 inches above, and the lowest 4 inches below summer level. The highest temperature of the water during the month was 74°, and the lowest 64°, while the highest temperature of the air at the same place was 89°, and the lowest 61°. These observations were made daily at 9 a.m. The rainfall during the month was 1·23 inches. The water at the Thames intakes was generally very good during the month. The West Middlesex Company is the only Thames company at present which, having large reservoir capacity, avoids taking in water during floods. The Lambeth Company are making large subsiding reservoirs at Molesey, and the construction of additional subsiding and impounding reservoirs by the Chelsea, Grand Junction, and Southwark and Vauxhall Companies is most desirable, so that when the river is in a turbid condition the flood water may be allowed to pass.

NOTTINGHAM GAS AND WATER WORKS.

The Quarterly Meeting of the Nottingham Town Council was held on the 3rd inst.—the MAYOR in the chair.

The Gas and Water Committee made the following report:—

The Water-Works.

The Gas and Water Committee report that in pursuance of the instructions they have received from the Town Council they opposed the passing of the Nottingham Water Bill in the House of Lords.

The bill came on for hearing on the 4th of May last, before a committee of which Lord Sligo was the chairman. The decision of the committee gave the company the amount of capital which they asked for—viz., £100,000, but reduced the rate of dividend from 7 to 5 per cent. The committee refused to impose upon the company the auction clauses.

Your committee therefore felt it incumbent upon them, in a matter of such grave importance, to take the opinion of a committee of the House of Commons.

Your committee met several times and anxiously reviewed their position. It seemed impossible for the council ever to acquire by voluntary purchase the undertaking of the water company, if they succeeded in raising the £100,000, without the sanction of the auction clauses; and in deference to the very strong feeling that there is generally in the council and in the town that the water should be in the hands of the public authorities, your committee resolved to make to the water company a further offer, which was conveyed in the following letter:—

Town-Clerk's Office, Nottingham, July 4, 1874.

Dear Sir,—I am instructed on behalf of the Town Council of this borough to offer to purchase the undertaking of the Nottingham Water-Works Company on the following terms:—1. To pay to each shareholder, in respect of each £50 share, an annuity of £3 2s. 6d. for the first three years after the contemplated completion of the purchase; for the then next four years £3 5s.; and then, in perpetuity, £3 7s. 6d. 2. To pay up the arrears of old dividends within a reasonable time after the completion of the purchase. 3. The company and the corporation to enter into a preliminary agreement, and to promote jointly (if necessary) a bill for carrying out the arrangements during the next session, or some subsequent session of Parliament. This offer is made on the following conditions, namely:—1. The company to withdraw from the bill now before the Commons the clauses enabling the company to increase their share and loan capital. 2. The company to refrain from converting the residue of their loan capital into share capital. This letter is written without prejudice, and is not to be used in any future proceedings in the event of the negotiations not coming to a favourable issue, and the offer hereby made is to be considered withdrawn if the conditions are not complied with. Please bring this letter at once under the notice of your directors, and oblige, yours faithfully,

(Signed) S. G. JOHNSON.

S. Maples, Esq., Clerk and Secretary to the Nottingham Water-Works Company.

This offer was refused by the directors, who have all along entertained a most exaggerated notion of the value of the water undertaking.

The bill was therefore fought out in the Commons. Your committee regret to report that the company were successful in retaining the advantages which they had gained in the House of Lords.

The company will be entitled to the premiums on the new capital as it is allotted. There are 5000 shareholders at £50 each, who will be entitled to an allotment of £100,000 share capital, and £25,000 loan capital, amounting in the whole to the sum of £125,000. Each £50 share will be entitled, therefore, to an allotment of £25 of the new capital. The market value of the shares of the company at 4 per cent. is £62 10s. The bonus, therefore, secured to every shareholder by the parliamentary success of the company will equal £6 5s., reckoning that people will not invest their money in such property without they obtain a return of 4 per cent.; although there may be times when speculation will carry shares above that price, in the long run the public will not invest moneys on such securities at a lower rate of interest than 4 per cent. The result, therefore, is that the shares, which are now worth £62 10s., will be worth for a short time only the sum of £68 15s. After the bonus has been realized, the shares will fall to a price varying from £60 to £62 10s. The last offer which the corporation made by the above letter of the 4th of July has been valued by Messrs. Turquand and Co., of Token-house Yard, London They say that the offer made by the Nottingham Corporation to purchase each £50 share of the company by securing to each shareholder an annuity for three years of 6¼ per cent., or £3 2s. 6d.; for the following four years of 6¼ per cent., or £3 5s.; and afterwards in perpetuity of 6¾ per cent., or £3 7s. 6d., is equal to a sum of £83 5s. 6d., if capitalized at 4 per cent., and at the end of seven years, and after the payment of the annuities of £3 2s. 6d. and £3 5s. for three and four years respectively, would be equal to a sum of £84 7s. 6d. if capitalized at the same rate of interest—viz., 4 per cent.

Your committee feel that the directors having refused the extremely liberal offers which have been made, it is desirable that any further negotiation on the part of this corporation should cease.

Your committee, therefore, recommend that all offers which have hitherto been made be formally withdrawn by the town-clerk.

Your committee regret exceedingly the termination of the long negotiations with the company, but they feel that the very utmost has been done in order to meet the directors and to secure the undertaking for the town.

Mr. HEATH (chairman of the committee), in moving the adoption of the report, said the council would have gathered from the report that, notwithstanding all the labour of the committee, they had failed of success. The committee had offered 6¼, 6½, and 6¾ per cent. to the shareholders, but the directors had refused the offer. The labours of the committee having come to an end, it had occurred to the committee that any further negotiations between themselves and the directors of the water company should cease. At the present time the shareholders of the company divided 5 per cent., and no more; but the committee, desiring to meet them in a liberal spirit, proposed to give 6¼, 6½, and 6¾ per cent. He believed that that would have been accepted by the directors on certain terms, and it was due to the town that it should be known what were the reasons on which the offer was at length refused. The directors appeared to have got the notion that they had a vested interest in this undertaking, and to have regarded themselves as persons who should be bought out. They required not only 7 per cent., although they agreed to take 6¾, provided they would give up among the directors one quarter's collection. The committee felt indignant at such an offer, and refused it at once. It was thought advisable, however, that the committee should seek to secure to the town some of the advantages of further legislation, and when the company sought for a new bill in the House of Lords, with the view of increasing their borrowing powers £125,000, and abolishing the auction clause, the committee ook further action. Having observed that the company was in debt to a large amount, having a considerable indebtedness at the bank, he said it was candidly confessed by Mr. Hawksley, in London, that £50,000 would be required to liquidate the liabilities of the company in its current account. The committee did not oppose the borrowing powers, but sought to retain the auction clause. The present share capital of the company was £250,000. Of that sum £75,000 was a mere figure, merely nominal, their present actual capital being £187,000. For this enormous undertaking, which had been brought into its present position by an expenditure of £187,000—over and above, of course, what they had borrowed—the offer of the corporation was to pay £250,000. They had, in fact, offered a premium of £105,000 to the shareholders. Under the terms proposed, by the purchase of the undertaking, about £83 per share would be realized. Having observed that the company would have to find this £125,000, he said supposing it could be sold as they sold their present shares, every £50 share realizing £62 10s., it gave a sum in favour of the shareholders of £32,350 as against £105,000 offered by the corporation. The total dividend at present prices was 4½, while the corporation offered 6¼ to 6¾.

If the shareholders thought that the offer made by the corporation was one which should be accepted, it must now come from them, for he scarcely imagined that the corporation were likely to go down on their knees to ask the directors for this undertaking. Supposing the company to go on as they had done, what would be the result? Mr. Hawksley admitted that the present shares were at a fictitious value, and that it arose through a feeling outside with respect to the probable transfer to the corporation. In other words, looking at the amount of excess, they had put up their shares at an illegitimate value, and this produced what Mr. Hawksley called speculation. Mr. Hawksley stated that this money was to extend the area of the company's work. Now the substantial income of the water company came from the borough and the adjoining districts, such as the Park, Sneinton, and Radford, and the outlying districts did not pay for the extensions. If the shareholders, through their directors, resolved that the undertaking should not be transferred to the town, he trusted that there was sufficient energy and public spirit in this town and neighbourhood to say that Nottingham, in union with those districts he had mentioned, should have its own water-works, and that the town should thus be properly supplied with water. He then moved a resolution embodying the recommendations in the report.

Mr. SKINNER seconded the motion.

Alderman THACKERAY said he should strongly advise the council not to offer the 6¾ per cent. again. He made the offer under the idea that it would be accepted, and had he thought it would have been received in the way it was, he would not have made it. He considered the price most unreasonable. Looking at the position of the company, and the desirability there was of putting an end to these constant parliamentary fights, he was then prepared to advise the corporation to give the large sum they had heard mentioned. Upon what ground they refused that offer he was unable to conceive, at least in the interests of the shareholders. Mr. Heath had thrown out an insinuation with regard to the directors which he must repudiate as far as some of them were concerned, believing they would be the last men in the world to accept bribe of any sort. How such an offer could have been made he could not understand, because the corporation offered to compensate their servants. He understood a shareholder could not hold more than 40 shares. By the offer of the corporation a shareholder would receive for his 40 shares a premium of £840. If the company continued to carry on the works, and expended the £125,000 they had raised, the premium would be £240. Having further enlarged upon the financial aspect of the question, he said he had never considered that water ought to be made a matter of commercial speculation. He considered it desirable, however, that both in this town and elsewhere the water supply should be in the hands of the district authorities. The town should be supplied with good water at any cost, which had not been the case. He hoped some legislative action would shortly be taken to place these matters in the hands of the public authorities. The Government would not be writing so many letters on this question if something was not intended, but he must say he had been grievously disappointed with the action of Parliament with respect to this company. How a committee of that House could break faith with the corporation, and run away from a bargain of the past to put £30,000 into the pockets of the shareholders, he could not understand.

Mr. WARD asked for some further explanations as to the breaking off of the negotiations. It was said to have arisen upon the question of compensation to officers.

Alderman BARBER did not think the negotiations broke down at that particular question. He believed that when the committee failed as to the auction clause, the directors formed an exaggerated notion of the value of the company and made up their minds that they would not take less than 7 per cent. As far as he was concerned, he had always opposed the price offered by the corporation as being too high.

After some further conversation, the report was adopted.

Alderman BARBER: I take it for granted that the committee is dissolved.

The MAYOR acquiesced.

The same committee also presented the following report:—

The Gas-Works.

The Gas and Water Committee report that the terms mentioned in their report presented to the Town Council on the 23rd of March last, as those upon which the undertaking of the gas company might be acquired by the corporation, have been finally arranged and embodied in an Act of Parliament which received the Royal Assent on the 16th day of July instant. Your committee have to congratulate the council on the advantageous provisions which have been inserted in the Act.

The bill was originally threatened with a very serious opposition by several large landed proprietors and others interested in various parts of the district of the gas company within the county. After several interviews, arrangements were made for the withdrawal of that opposition on terms which your committee think were equitable, and such as will place the supply of gas by the corporation upon a permanently satisfactory basis.

In March, 1873, at a time when the gas company were applying to Parliament for additional powers and liberty to pay an increased dividend, the council passed a resolution pledging itself to take all steps necessary to promote, during the then ensuing session of Parliament, a bill, if necessary, for the transfer to the council, either alone or jointly with such other of the adjacent urban and rural sanitary authorities as might be willing to concur with the council, of the undertaking of the Nottingham Gaslight and Coke Company, upon such terms as the committee appointed on the 6th day of January then last, to conduct on behalf of the corporation the opposition to the bill promoted by the Nottingham Gaslight and Coke Company, should determine to be fair and reasonable.

Your committee, therefore, deemed it prudent to insert in the gas bill clauses enabling the corporation and the sanitary authorities, in whose district gas is supplied, to enter into mutual agreements for the purpose of administering the gas supply. Such clauses have been inserted, and now form part of the Act of Parliament.

The Act contains powers for the corporation to borrow, and notwithstanding an attempt was made by the Local Government Board to place this power under their control by providing that no money should be borrowed without their previous sanction, the attempt was defeated; and, though renewed in the Commons, was not successful there. It would have been almost impossible to have carried on the works of the gas company if the corporation had been fettered in its powers to raise capital, by having in the first place to apply to the Local Government Board whenever it should have been found necessary to exercise its borrowing powers.

Your committee have taken considerable trouble with the section of the Act which provides for paying off the mortgages by instalments or sinking-fund. They have succeeded in obtaining for the council the option of paying off any money borrowed by means of a sinking-fund appropriated for that purpose, and which, with the accumulations thereof, shall, in 75 years, extinguish any debt contracted by the corporation in respect of the gas. A great struggle took place in the House of Lords with Lord Redesdale, and it was not without a very great deal of difficulty that the term of 75 years was secured in that House. In the committee of the House of Commons, Mr. Cecil Raikes, the chairman of Ways and Means, assisted by Mr. Sclater-Booth, the president of the Local Government Board, offered much opposition to the council obtaining so long a term as 75 years, but owing to the explanations given by Mr. Saul Isaac, one of the M.P.'s for the borough, the committee of the Commons agreed to allow the 75 years already granted by the House of Lords. In their efforts in this direction your committee have to report that Mr. Saul Isaac rendered much and valuable assistance.

The Act does not restrict the investment of the sinking-fund to Government securities. The council will, therefore, be able to invest the sinking-fund on such securities as they may think fit.

The Act also contains a clause enabling the council to reborrow any amount borrowed by them under the Act, and paid off otherwise than by instalments or by means of a sinking-fund.

It seems, therefore, impossible that any heavy burden can fall upon the borough under the provisions of the Act for the repayment of borrowed money.

Inasmuch, however, as the corporation can always borrow money at 4 per cent. so long as the gas annuities can be purchased at anything under that rate, it would be always advisable that they should be bought up for the benefit of the town, as far as the means at the disposal of the corporation will permit.

When the maximum charges for gas specified in the schedule to the Nottingham Gas Act of 1858 are not reached, the application of any surplus revenue will be entirely at the discretion of the Town Council, who may appropriate it for the borough and the public benefit of the inhabitants in such manner as they think best. When the rates exceed those mentioned in the above schedule, the corporation will not be able to apply in any one year, in the manner lastly mentioned, any sum exceeding £5000.

Your committee consider that this will be an arrangement which will give complete satisfaction both to the ratepayers and to the consumers of gas. On the one hand, it was evidently unfair that the Town Council should take upon itself the responsibility of the administration of the gas supply, and be incapable of realising any advantage from it for the general benefit of the ratepayers. On the other hand, it was equally important that the supply of gas, upon which so much of the success of our manufacture depends, should not be taxed unduly in the shape of heavy rates for the supply of gas.

Your committee do not think it necessary to further refer to the details of the bill.

The certificates of annuities will have to be prepared and register-books obtained, and the whole of the management of the gas will now pass into the hands of the council.

It is absolutely necessary that the council should appoint a committee, in whom it can place implicit confidence, and to whom it will be imperative that the council should delegate the whole of its powers with regard to the management of the gas. That committee will take the place of the committee of management appointed by the shareholders of the late company, and will have to exercise the same powers and authorities in relation to the Town Council which the committee of management exercised in relation to the shareholders.

Your committee trust that their labours, which have been extremely arduous, and have given them much anxiety, will be satisfactory to the Town Council, and that the acquisition of the gas company will prove of lasting benefit to the town.

Before closing their report, your committee desire to add that in their opinion the best thanks of the council are due to your very able town-clerk, Mr. S. G. Johnson, for the invaluable aid he has given in the attainment of the gas transfer to the corporation, and to the borough engineer, Mr. Tarbotton, for the great assistance he has rendered them in their labour. To the town-clerk's labour, skill, and unremitting care many of the most valuable clauses of the bill are mainly due, hence your committee desire, in a matter of so much importance, to put upon record this expression of their high appreciation of your town-clerk's services, and of the very valuable assistance he has rendered to the town.

Dated the 31st day of July, 1874.

Mr. HEATH, in submitting the report, congratulated the council on having acquired this valuable property on behalf of the town. Although they had failed in the matter of the water-works, it was satisfactory to know they had been successful with the gas, and that the property was now being transferred to the corporation. The share capital of the company was £352,000, in £50 shares, its bonus at 4 per cent., £40,000, its annuities at 6½ per cent., £24,231. The bank debt of the company was £27,446, and upon that they had been paying 5½ per cent., but the committee had already paid off £20,000 at 4 per cent. The other liabilities of the company were to the amount of £1295. The existing assets, independently of the works of the company, consisted of a quarter's collection, amounting to £16,000; good debts, £6000; stock of coal, cannel, &c., amounting to over £22,000; making a total of £44,066. Out of its revenue the company had spent £25,000. The revenue-fund was £23,000, which was invested in Consols at 3 per cent., but it was desirable that the corporation should have the power of re-investing that amount, and that would be at the rate of 4 per cent. Owing to the arrangements which had been made with the gas company, the corporation would be able to pay off the annuitants without burdening the town or the consumers of gas. The works were in excellent condition, and much larger than was at present required. The mains of the company extended over 150 miles, were in good repair, and there was not likely to be any great alterations made in them for eight or ten years. The present price of gas was 3s. 1½d. to 3s. 4d., being lower than charged by any other company in England. Looking at the falling off in trade, it was possible there might be a falling off in the consumption of gas, which would cause a diminution in rental, except it was made up by increased main power. He had reason to hope, however, that their local trade was gradually reviving. The extent of mileage was 14 miles across the country. He trusted that this great undertaking having been transferred with such kind feeling on the part of the directors, that a large amount of benefit would accrue to the town, and that by such means they would be able to provide the town with improved public buildings without resorting to the imposition of fresh burdens. He concluded by proposing certain members of the council as a committee of management, and read a resolution defining their duties.

The motion was, after a brief conversation, adopted.

EXETER TOWN COUNCIL.

ALLEGED NUISANCE FROM THE GAS-WORKS.

At the Meeting of the Exeter Town Council on Wednesday last—the MAYOR (Mr. Follett) presiding—the following letter was read from the gas company relative to a complaint of nuisance arising from their works:—

Dear Sir,—Referring to your letter of the 2nd ultimo, and the report of the surveyor to the local board, relative to the nuisance alleged to proceed from the Basin Gas-Works, I am desired to inform you that both have received the very careful consideration of the directors; and, although they are convinced that the smells referred to, and which are complained of throughout the city and neighbourhood, do not proceed from their works (the same process being in operation up to this time as the company have had in use since the works were first established in 1835), yet being anxious to meet the wishes of the local board in every possible respect, and for the purpose of testing the recommendation contained in the surveyor's report, they have determined at once on the use of oxide of iron in their purifiers, and this process is now in work. The tar and liquor pits are now and have always been covered, and the directors desire me to add that the works shall be at all times open to the inspection of your surveyor.

(Signed) W. PADFIELD, Secretary.

Mr. WELSFORD asked what date the letter bore.

The TOWN-CLERK replied the 10th of August.

Mr. WELSFORD said his reason for asking was that the stench was worse last Thursday night than at any time they had complained of.

The MAYOR said he did not know exactly when the change in the operations commenced, and therefore they were a little in the dark as to the results that had followed. He was glad, however, to find that the letter which had just been read was couched in somewhat more courteous and definite terms than the communication with which they were favoured by the gas company a month since—glad of it, because it led them to believe that there was, at all events, amongst those who governed the gas company, a desire to co-operate with the city in order to abate a common evil. It was but right that these great companies, which had given them, by Act of Parliament, a monopoly of supply to any centre, should look upon themselves not as antagonistic to the people to whom they gave these supplies, but as a body acting in alliance with the community, and acting in alliance with the community for mutual benefit. This was the spirit in which these great companies ought to deal with the cities in which they existed; and he was glad to observe, from the letter which had just been read, that there was some indication of such a spirit existing amongst the gas company, because, although it was convenient that the supply of the great necessities of light and water should be taken up by the enterprise of certain individuals, yet they all agreed that the best way for their management was that they should be in the hands of the local authorities. He said this because, from the numerous suggestions he had seen as to how this great evil could be best rectified, the one which had been laid most stress upon was that the council should, as the governing body of the city, establish gas-works of their own to compete with, and act as rivals to, the existing gas company. He had stated it before, and he repeated it now in order to show that the council had not been guilty of any neglect, that, under the existing state of the law, it was not in their power to take any such step. The Gas and Water Facilities Act and the Borough Funds Act both stated that the local government authorities should not move for the establishment of gas or water works

where there were any existing gas or water works established by Act of Parliament; therefore, as the law stood, this company had the monopoly. He did not think they should all agree that this was as it ought to be, and the Municipal Association, which they joined last year, had taken up that point very earnestly. Twice he had attended as a deputation before the Home Secretary, urging the alteration of the law in that respect. Lord Aberdare promised that there should be an alteration, and introduced a bill, but the bill, like many others, was lost in the general slaughter of the innocents. Mr. Cross had not stated what he would do, but, in answer to a question put to him by Mr. Mills, at his (the mayor's) request, he had intimated that a bill upon the subject would be introduced next session. Therefore it was not only right that these companies should act in a friendly spirit, but it was positively to their own interest to do so, otherwise they would find that the monopoly which they now enjoyed would be taken from them. That was one legislative change which he hoped would soon be made, but he must digress for a moment and speak of another, because it bore upon the same point. Another legislative change which he hoped the association would take up was for giving greater facilities to municipalities for the extension of their areas. He did not suppose there could be found anywhere in the whole country a place where facilities of that kind could be more advantageously made use of than in Exeter. Here they had in one town the absurdity of two governing bodies, the absurdity of being obliged to have two staffs of officers, and two School Boards, in order to govern what was entirely in one town. They had seen that day an instance of how the general community suffered simply from the fact that there were two jurisdictions in one city. There was nothing which had conduced so much to the continuance of this horrible smell as the fact that the works were situated in one jurisdiction and the parties who were annoyed by the smell resided in the other. He did not wish to frighten anybody in St. Thomas about this matter, but in the interest of economy, and for the benefit of all parties, he thought there ought to be one governing body instead of two, and any person who took steps to bring that state of things to pass in this city would confer a great benefit upon the community. The letter which they had received from the gas company reminded him of these several points. He was glad that, standing as the company did in the city, they had adopted a better tone than that which characterized their communications a few months since. He was confident that if the suggestions contained in the surveyor's report were properly carried out by the company they would experience a very considerable benefit. He was not going to say that there were not other things that caused a smell in the city, but he felt pretty confident himself from what he had seen in London, and from what he saw at the gas-works, that the evil which had been pointed out was at all events the chief evil which occasioned the smell over the city. Referring to a suggestion made in the papers a few days ago that the nuisance was caused by the throwing of hot water over the culm, the mayor went on to say that he had seen that operation performed over and over again at the gas-works, and he saw it performed several times in London without the slightest smell whatever arising from the operation. Moreover, in the London gas-works they had universally abolished the system of purification by lime, because of the smell which arose from it; but they had none of them found it necessary to stop pouring water over the culm, and they had not received the slightest complaint of smells arising therefrom from people living in the neighbourhood of the works. A month had elapsed since the date of the last communication. The gas company had done something, but he thought it right to say that the council had not been idle. They had obtained the opinion of no less an eminent counsel than their recorder, who had given the matter his most careful consideration, and advised them what line of action to take; and although he hoped it would be unnecessary to resort to the measures indicated, still he was sure he was but expressing the opinion of the council when he stated that it was their determinate resolve to exterminate the nuisance, and that if one step did not answer they would go on step by step until they had driven it entirely from amongst them. He said that emphatically, and he laid stress upon it because he wanted the citizens to believe it, and, just once in the way, place a little confidence in their local representatives, at all events upon that subject. Although it was right and natural that those who suffered from the evil—that those who found their families made ill and their property deteriorated—should angrily sit down and write to the public journals, and whilst it was right that the public journals should take up the remarks of their correspondents and write articles upon them, if the council were neglecting their duty; yet if the latter could show they were doing everything they could do, he wanted the public to consider whether it would not be more beneficial to the city if these constant complaints of Exeter being a foul, dirty, and almost unbearable town were not published, and a little more confidence was placed in the council. Complaints had been made as to the condition of the river, but he did not believe it was more foul than any other river throughout the country which washed the feet and foundations of a large city. He again asked that confidence might be placed in the council, and concluded by proposing the following resolution:—"That the letter of the gas company, and the whole question as to the smells complained of, be referred to the General Purposes Committee, with power to take such action as they may see fit, and that the surveyor be directed to visit the gas-works to see whether his suggestions had been thoroughly carried out, and report to the committee."

Mr. Hughes, in seconding the mayor's resolution, said he did not expect that the city would get rid of the nuisance unless they resorted to the measures allowed by law, for he looked upon the denial in their letter that the nuisance arose from their works as a bad sign of repentance. The fullest powers ought, therefore, to be given to the committee.

The resolution was unanimously agreed to.

Ashford (Kent) Gas Company.—At a meeting of the shareholders of this company, on the 10th inst., the question of the public lighting of the town came on for discussion, the local board having refused to pay the price asked by the directors on a renewal of the contract—viz., £5 5s. per lamp per annum. After a somewhat stormy debate, the shareholders resolved that instead of a dividend of £6 per cent., as recommended by the directors, a dividend of £5 per cent. only should be declared, and that the charge for gas should be reduced from 6s. 3d. per 1000 to private consumers, and £5 5s. per lamp per annum to the public, to 5s. per 1000 to private consumers, and £5 per lamp to the public.

Huntingdon and Godmanchester Gas and Coke Company.—The annual meeting was held on the 5th inst. The directors reported a decrease in the business of the company and the profits arising therefrom. The decrease in the coke sales was attributed to the mildness of the past winter, and in the fitting business from the fact that nearly all the inhabitants likely to be consumers of gas are now consumers, and consequently less fittings required. A loss had been sustained by an unfortunate contract for the sale of coke injudiciously entered into by the late manager, Mr. Stevenson. The decrease in the profits had arisen partly from the before-mentioned causes, but principally from the unsatisfactory state of the coal market rendering the directors unable to obtain the coal they desired at satisfactory prices, and partly from unsettled management, the directors having had three changes since the death of Mr. Edgar Church. The proceeds from the sale of gas were about equal to those of the previous year, but a very much larger quantity of coal had been consumed in the manufacture. The balance-sheet showed a sum of £564 16s. 0½d. available for dividend, and the directors recommended that a dividend of 6 per cent. be declared, free of income-tax, and that the deficiency necessary to be added to the above balance to pay 6 per cent. be debited to the reserve-fund.

EDINBURGH AND DISTRICT WATER SUPPLY.

THE MOORFOOT WATER-WORKS.

This scheme (of which Messrs. F. and A. Leslie are the engineers) consists of a set of reservoirs for the impounding of water in the Moorfoot Hills. The proposed works extend over a considerable range of country, their remotest point being distant about 18 miles from the city. About two miles from the village of Eddleston, on the northern border of Peeblesshire, lies Portmore Loch, a beautiful sheet of water, fed by a small burn, and surrounded by picturesque hills, at the height of nearly 900 feet above the Ordnance datum level. This loch is so situated that by the construction of an embankment about 1000 feet long, resting at either end against the hillside, its level will be raised 10 feet. It will thus be converted into a reservoir, with an extreme length and breadth of 3600 feet and 2000 feet respectively, and a superficial extent of 94 acres, capable of containing 28 million cubic feet of water. For the conveyance citywards of the water thus impounded—which, by the way, is generally acknowledged to be of very superior quality—a conduit will be constructed with a gradual fall to the northward. This conduit will probably be partly closed and partly open, and along its course, which for a considerable distance follows the line of the Tweeddale Burn, arrangements will be made for gathering in the water flowing from the adjacent hills. Carried as it will be, for the most part, along the side of the valley, the cutting involved in its formation will be of a comparatively easy and inexpensive character. At a distance of about three and a half miles from Portmore, the conduit track reaches Gladhouse, where the engineers have laid out a great reservoir, which may be said to form the main feature of the undertaking. It is here intended to collect the water of the South Esk, Gladhouse Burn, and Tweeddale Burn, by damming the course of the first-mentioned stream with an embankment nearly 1000 feet long, and in the centre 70 feet high. The water thus held back will spread over the country in a lake of curiously irregular form, with an extreme length of over 6000 feet, a breadth of 5000 feet, a superficial area of 363 acres, and a storage capacity of 236 million cubic feet. While largely drawn upon for city supply, this reservoir is also to furnish to the South Esk a daily quantity of 2,264,000 gallons, to be discharged in a continuous and uniform stream during the whole 24 hours. The top of the embankment being 797 feet above Ordnance datum, there is ample fall for the conduit which is to carry the water available for Edinburgh over the next few miles of its journey. The conduit system of conveyance, it should be explained, is in some respects preferable to piping, and therefore it is adopted wherever a uniform slope of the ground in the direction which the track must follow admits of its being resorted to. Such, as we have seen, is the state of matters between Portmore and Gladhouse; and so it is, likewise, for a considerable distance to the north of the latter point. After leaving the great reservoir, the conduit follows for about half a mile the valley of the South Esk; then it strikes off to the north-west, and, after crossing the public road at Fountainside, is carried by a tunnel, 1200 feet in length, through a projecting spur of the hills. At the distance of about three miles from Gladhouse, the track reaches the Fullarton Burn glen, and here, from the sudden alteration of levels, the conduit has to give place to an iron pipe. Dipping down into the glen with a sharp bend, the pipe is carried across the burn in one span, and then rises again as rapidly to the general level of the country. At Edgelaw, on the Fullarton Burn, immediately to the west of the pipe track, and about a mile from the village of Temple, a compensation reservoir is provided, in lieu of the water proposed to be abstracted from Portmore Loch and the Tweeddale Burn. As originally designed, this reservoir, to be formed by throwing an embankment across the burn, was to have had an extreme length of nearly 7000 feet, a breadth of about 1000 feet, and a depth at the centre of the embankment of over 70 feet. Owing, however, to the arrangements which have been made for compensation in other directions, these dimensions will, we understand, be considerably reduced. The necessary surveys not having been made, the new measurements cannot yet be given, but the reservoir will be constructed so as to afford storeage to the extent of 44 million cubic feet. The water thus accumulated is to be used exclusively for compensation, and, as in the case of certain existing reservoirs in the Pentland Hills, the regulation of the supply will be placed under the control of a committee of the proprietors for whose behoof it is provided. From Fullarton Burn the pipe conveying the city supply passes with a gentle fall through a moderately level district, cut up here and there with small watercourses. Making a sharp bend to the north-west, the track crosses the Peebles Railway near Roslin Station, and then drops into the valley of the North Esk, which river it crosses in two spans of 36 feet each. On emerging from the valley it falls into the line of the existing pipe, which it follows, thence through the village of Burdiehouse, and on by Liberton Dams to the south side of the city. The service reservoir for distribution of the supply is to be formed at Alnwick Hill, at the height of 304 feet above Ordnance datum. This work will take the form of a vast square tank, measuring 450 feet each way, and having in the centre a depth of 25 feet.

While it may be said that throughout nearly its whole length the conduit and pipe track will have to be carried across country, it does not appear that, with the exception of the 400 yards of tunnelling to the south of Fullarton Burn, any heavy works will be required. The cuttings, generally speaking, will pass through soft material, and the deepest of them do not exceed 25 feet, while the average depth must be expressed by a very much smaller figure. The most formidable portion of the undertaking is, of course, the construction of the reservoir embankments. To secure due stability for these, immense trenches will have to be dug, huge walls of puddle clay built up to the proposed water level, and these covered over with thousands upon thousands of tons of earth closely rammed down till mounds are produced almost rivalling in solidity the hillsides against which they rest. The position selected for the embankments here in question are said to be good, so that nothing is required but thorough-going workmanship to attain satisfactory results.

In addition to the works thus briefly described, the Act just passed authorizes the construction of a supplementary reservoir, to be known as Denscleuch, in the heart of the Pentland Hills. It has been found that a considerable portion of the water flowing in the great Glencorse valley at present runs to waste, and accordingly it is proposed to provide additional storeage with the view of husbanding this overflow. The site chosen for the new reservoir is the glen between Bells Hill and Blackhill, not far from the west end of the existing Glencorse reservoir. An embankment, about 800 feet long and 78 feet high, thrown across the lower part of the valley, will have the effect of forming an artificial lake 3600 feet in length, and with an extreme breadth of 750 feet, tapering away to a point at the west end. Here will be impounded the water of the Whitecleuch Burn, together with the overflow of the Loganlee reservoir, lying further west in the hills, which will be brought down in an open conduit. The top of its embankment being 740 feet above Ordnance datum, the new reservoir will have ample headway for the discharge of its contents, which will be sent down the valley to assist in keeping the city supply-pipe contantly full. —*The Scotsman.*

Airedale Gas Company.—The half-yearly meeting of this company was held on the 10th inst., in the company's offices, at Idle. Mr. Robert Sutcliffe, chairman of the directors, presided. A dividend at and after the rate of 10 per cent. per annum was declared and was paid forthwith, leaving a balance to be carried forward to the next half year. It was stated that the directors had made a call of £1 per share on the 1176 new shares, for the purchasing of coal trucks and other purposes.

ANTHRACENE AND ALIZARINE.

By Frederick Versmann, Ph.D.*

In accepting the invitation to lecture before you on one of the most important and most interesting recent chemical discoveries, I had to consider whether I should treat my subject in preference from a practical or from a scientific point of view.

Looking at the object for which this series of chemical lectures has been arranged by the council, and believing it to be decidedly of a practical nature, I have thought it best to confine myself as much as possible to the practical side of my subject, and to consider the theoretical part only so much as may be necessary for a general understanding. I have done so all the more readily, because I shall thereby be best enabled to point out the great advantage and the absolute necessity of constant scientific investigation of apparently very simple manufacturing processes, and also because I am anxious to invite a discussion on several practical points, which are surrounded by much uncertainty; and I should be much pleased if such discussion should assist in clearing away some of the uncertainty and dissatisfaction at present attached to the true value of an article which suddenly has assumed such vast importance.

I may at once remark that, although my paper is "On Anthracene and Alizarine," I have found it impossible to do full justice to both subjects in one evening. I shall therefore limit myself to-night chiefly to the consideration of anthracene, and I shall touch but lightly upon its conversion into colouring matter; but I hope I may have, at some future time, an opportunity given me to fully discuss the various processes which produce these chemical changes, and result in such splendid and beautiful compounds.

In tracing the history of anthracene, we find that the two great French chemists, Dumas and Laurent, in 1832, first obtained it from the last fractions of the distillation of coal tar; they exposed the oily matter to extreme cold, when a crystalline deposit separated, which was pressed and washed with alcohol; the residue was further purified by re-distillation, crystallization, and sublimation, and was then submitted to chemical investigation. Dumas and Laurent assigned to the compound thus obtained the formula $C_{15}H_{12}$, and as this is half as much again as naphthalene, $C_{10}H_8$, they named the new substance paranaphthalene. But this chemical composition and the low melting point, which was found to be 180° C., convincingly prove that the substance must have been a mixture of several hydrocarbons, and not a definite chemical compound.

Laurent afterwards submitted the substance to fresh investigations, and obtained several interesting derivatives, but, as Professor Knapp suggests, in his exhaustive historical memoir on "Anthracene and its Derivatives," published in the *Moniteur Scientifique*, Laurent evidently had at his disposal only small quantities of the impure hydrocarbon; he therefore could not determine the true composition of the substance, which he now named anthracene.

At present it is generally acknowledged that the compound these two chemists investigated was not pure, and that their formula is not correct; it is therefore the more surprising that Girard and Delaire, in their "Traité des Dérivés de la Houille," published only last year, repeat with strange tenacity Dumas and Laurent's antiquated statements; they treat paranaphthalene as an existing definite compound of the formula $C_{15}H_{12}$, although they have nothing new to add in support of their isolated opinion; on the contrary, they confess that the substance is little known, that the investigations are very old, and made very likely, not with a pure compound, but with a mixture of paranaphthalene and anthracene.

Fritzsche described, in 1857, a hydrocarbon, obtained from coal tar, which he found in many respects closely to resemble Laurent's anthracene, but which had a melting-point of 210° to 212° C., and the formula of which he found to be $C_{14}H_{10}$.

Anderson published, in 1862, a most searching investigation of the higher hydrocarbons from coal tar. He separated anthracene in great purity, obtained many of its most important derivatives, prominent amongst which stands his oxanthracene, or anthrachinon; which, however, had already been obtained by Laurent. Anderson retained Laurent's name of anthracene, but confirmed Fritsche's formula and melting-point.

So far, then, the hydrocarbon had been separated from coal tar only; but, in 1866, Limprecht demonstrated its formation, resulting from the decomposition of chloride of benzyl by water, in a closed vessel, at 180° C.; and in the same year Berthelot commenced the publication of his masterly researches of the action of heat upon the hydrocarbons, their origin, character, and composition. He pointed out the circumstances under which anthracene is formed by the action of heat upon the several more simple hydrocarbons; he found that toluol alone, or a mixture of styrol and benzole, or of benzole and ethylene, passed through a red-hot tube, furnished anthracene.

Berthelot's and Limprecht's results are, so far, exclusively of theoretical interest; at present, at least, there does not appear any chance of their investigations being capable of practical application. Berthelot also described the extraction of anthracene from coal tar, its purification, and its characters, and he confirmed Anderson's results. So far, all these investigations were of a purely scientific character; but, in 1868, two German chemists—Graebe and Liebermann—succeeded in reducing alizarine, extracted from madder, and in obtaining therefrom a hydrocarbon which corresponds in all its properties to Anderson's anthracene.

This, then, is the starting-point of one of the greatest revolutions in chemical industry, because, after having obtained anthracene from alizarine, it was comparatively easy to convert anthracene into alizarine, and thus the possibility was given of producing, by artificial means, one of the most important and most ancient natural colouring matters.

Several German manufacturers of aniline dyes at once commenced the solution of this problem, with more or less rapid success; and, although scarcely five years have elapsed since the first laboratory experiment was made, to-day we see a number of large works producing vast quantities of the artificial colour. The first and most important question became, of course, the sufficient supply of anthracene.

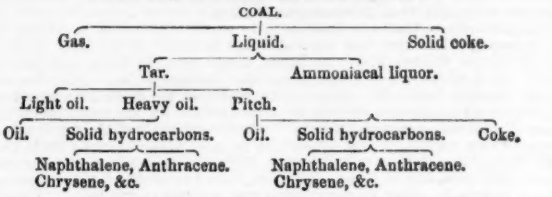
It is difficult to realize the idea that an article which was but yesterday unknown and useless, and of no commercial value whatever, should to-day be most eagerly sought after, and should command a high price. Such, however, is the case with anthracene, which has suddenly risen to greater importance than any of the other products of the distillation of coal tar. True, the application of benzol and its homologues imparted to this series of hydrocarbons an importance previously unknown, but it becomes almost insignificant if compared with the position anthracene has so suddenly and, no doubt, permanently assumed.

Before attempting to give a description of the manufacture of anthracene, I may be allowed for a moment to go a step further back, to draw your attention to the formation of tar, from which anthracene is obtained.

I need scarcely say that tar is one of the by-products in the manufacture of illuminating gas. Coal heated in a closed, red-hot retort, as shown in the diagram, is split up into a series of volatile and non-volatile compounds; the last remain in the retort as coke, while the volatile compounds are carried away by means of an exhauster; they pass through the ascension-pipe at one end of the retort into the hydraulic main, and then into the condensers. These are large upright syphons, and as the volatile compounds are made to pass through a whole series, they are cooled. The permanent gases pass on to be further purified and to be stored in the gasholders, while other products, carried away so far in the form of hot vapour, are condensed in the liquid form, and accumulate at the bottom. These liquid products consist chiefly of tar and water, which separates on standing; the tar is run off into the tar wells, and is ready for further treatment.

In drawing your attention to the following table, in which I have endeavoured to illustrate and to follow up the ultimate separation of anthracene from tar, but starting with coal and its conversion into gas and its by-products, I need scarcely remark that I could not have intended to give a complete representation of all the different compounds obtained in the operation, but that I have simply grouped them together in as few divisions as possible:—

Products of Destructive Distillation of Coal.



We have already seen that coal submitted to destructive distillation yields gaseous, liquid, and solid products. Passing over the gas and the solid, we separate the liquid into tar and into water, containing much ammonia, and which is therefore called ammoniacal liquor. The tar submitted to fractional distillations yields light oil, heavy oil, and pitch. These, I repeat, are only broad divisions, as obtained by the first distillation of tar. The oils contain several series of liquid hydrocarbons, the most important of which is the benzol series; a series of bases containing nitrogen, of which aniline is the type; a series of acids, foremost amongst which is carbolic acid; and, lastly, a whole series of hydrocarbons, most prominent amongst which we find anthracene.

Perhaps I ought to have given a complete list of all these compounds, with some of their characteristic physical properties, but as their number is very considerable—more than sixty, at least—I have limited myself to the solid hydrocarbons, as the only ones bearing directly upon our subject. These we shall have to consider later on, when speaking of the impurities which accompany anthracene.

In looking at the diagram you will observe that the pitch resulting from tar is further divided, ultimately yielding again anthracene. This is a process I shall have to speak of separately.

The manufacture of anthracene appears at the first moment to be extremely simple, an impression which, unfortunately, has taken hold of many tar distillers, and which accounts for the low quality of very large quantities of anthracene sold.

The well-known process of tar distilling, so the formula runs, is carried out as usual, and the last 10 or 15 per cent. of the products of the distillation are set aside and allowed to stand for some weeks, when a crystalline deposit of solid hydrocarbons separates; this is freed as much as possible from the adherent oil by filtration, pressing, or other mechanical means, when the residue, more or less dry and more or less impure, is ready for sale.

This, no doubt, is the necessary beginning of the process, which, however, should be further followed up, and ultimately result in an article of such purity that it might at once be converted into colouring matter—*i. e.*, an article containing at least 75 or 80 per cent. of pure anthracene.

True, in the early days of anthracene—and that is but four years ago—the alizarine makers were well contented to get anthracene of any quality, however low in per centage, because the success and very life of the new dye depended upon the possibility of getting large quantities of a hitherto unknown article. At that time the alizarine maker bought what he could get, often, perhaps, not knowing himself the value of the articles bought; but it is evident he did so unwillingly, and only of necessity, as is clearly shown by some remarks of Dr. Gessert's, one of the earliest and most successful manufacturers of alizarine, who wrote about three years ago as follows:—

"It is to be regretted that the tar distillers are not more careful in the manufacture of commercial anthracene. The manufacturer of alizarine has not at his disposal the necessary plant required for the purification of crude anthracene; at all events, he loses much time, and has no use for the oily residues resulting from the purification.

"The tar distillers, on the other hand, can always use these by-products along with their other oils. They ought to take the greatest care in the pressing of the well-filtered and drained anthracene, by using powerful hydraulic presses and by pressing, first cold, then hot, as strongly as possible. Such crude, well-pressed anthracene is readily powdered and passed through a sieve, and in this state of fine division it may be treated with petroleum spirit, boiling between 70° and 90° C., and after sufficient washing it may again be submitted to strong pressure.

"The price of crude anthracene of good quality is sufficiently high and remunerative to induce the tar distiller well to study the rational manufacture of the article, and to devote all his care to it."

Every word of these remarks, written three years ago, holds good even to-day, because only very few distillers are aware of the profit to be derived from purifying their crude product, and thus obtaining a high-class article. It is also true that, now that the question of producing large quantities of anthracene has been settled, the alizarine manufacturer buys but unwillingly a low per cent. article, and we see a new class of manufacturers spring up, which stand between the two former ones—viz., anthracene purifiers, who buy the crude anthracene and supply the consumer with an article of the desired purity. Of these anthracene purifiers there are several in Germany, and at least one in England; and nothing could speak more strongly in favour of my argument—that the first manufacturer should also be the purifier—than the fact that other people find it profitable to take up the purification as a separate business.

Of course, I do not for a moment under-estimate the difficulties connected with the subject; on the contrary, I am anxious to point them out, and to express my strong opinion that the whole manufacture must be looked upon not so much as a mechanical, but rather as a chemical, operation—that it requires a chemist's constant care and scientific investigation, without which only partially satisfactory results can be obtained; because after first having obtained the crude product, what is the question to be solved? Is it not the separation of one substance from a number of other substances extremely similar in their physical properties; and can such separation be successfully carried out, especially on the manufacturing scale, without an intimate acquaintance with all these substances? Certainly not; and, moreover, the production of the first article ought to be based upon scientific principles as well; because we must assume (and there is little doubt of this view being correct) that the greatest part of these solid hydrocarbons does not exist ready formed in the tar, is during the distillation not simply vaporized and afterwards again condensed, but that it is the product of decomposition by heat of more simple compounds; and if this be so, will not the study of the effects of heat under varying circumstances become of the utmost importance, and lead to most valuable results. I do not lose sight of the fact that, for the tar distiller, the mechanical part of his business is of the greatest importance, such as the suitable arrangement of his plant, the economical carriage from one part of the works to the other of the bulky raw material and its products,

* A paper read before the Chemical Section of the Society of Arts, March 20, 1874.

&c.; but in order to derive full benefit from his operations he should be guided and assisted by experience derived from investigation.

Anthracene having become of such great commercial importance, its most exhaustive scientific examination became a matter of course; and the last few years have brought us, especially from Germany, a number of most valuable investigations on nearly all the solid hydrocarbons. Berthelot had previously separated and described many of them, but perhaps he had not sufficiently large or sufficiently pure quantities to work upon; at all events, more recent publications, the results chiefly of Graebe's and Liebermann's researches, have somewhat modified several of Berthelot's conclusions. In the following table I have given a list of these solid hydrocarbons, their formulæ, melting-point, and boiling-point, as far as they are known at present:—

Name.	Formula.	Melting Point. Degs. C.	Boiling Point. Degs. C.
Naphthalene	$C_{10}H_8$	79	220
Acenaphthene	$C_{12}H_{10}$	100	285
Fluorene	—	113	305
Phenanthren	$C_{14}H_{10}$	110	340
Anthracene	$C_{14}H_{10}$	213	360
Pyrene	$C_{16}H_{10}$	180	—
Chrysene	$C_{18}H_{12}$	248	360
Retene	$C_{18}H_{18}$	95	400
Benzerythrene	—	—	—

Variable quantities of all these compounds are found in commercial anthracene, and their complete separation becomes extremely difficult. In treating the commercial article, it will always be best to remove the oil as completely as possible before attempting any further separation, and, for this reason, the oil itself is almost the best solvent of all the solid hydrocarbons, including anthracene, which is shown by the fact that, after the settlement of the crystalline deposits in the oil, a considerable quantity is often re-dissolved with a slight increase in temperature of the air; if, therefore, a sample, containing much oil, is treated with a solvent, the combined action of oil and such solvent removes considerably more anthracene than the solvent alone. This remark holds good with alcohol and bisulphide of carbon analysis; a soft sample containing much oil always shows a lower per centage than the same sample previously pressed and separated from the oil.

The attempt to give a separate and distinct account of the characteristics of these solid hydrocarbons would be useless for practical purposes, because, with the exception of the first and last, they are extremely similar to one another, and a quantitative separation becomes a matter of great difficulty. The difference in the action of alcohol, ether, bisulphide of carbon, benzol, petroleum, and other solvents is merely a matter of degree. Nitric acid and sulphuric acid, chlorine and bromine, produce similar compounds of addition or substitution. A solution of picric acid, mixed with a solution of the hydrocarbons, forms a series of compounds varying in colour from yellow and light orange to dark blood red, but which are so little stable that even an excess of the solvent—alcohol, for instance—separates the acid again. Even similar products of oxidation are obtained from most of them, at least as they have been studied. Naphthalene may pretty easily be separated; all solvents take it up most freely; the low melting and boiling point is very marked; even water vapour carries it off, and it may thus be purified. It is formed during the manufacture of gas, and is partly carried off and held in suspension by the gas. With a fall in temperature it often solidifies in the gas-pipes, so as almost to choke them up, and thus often becomes a great nuisance to the gas manufacturer, especially as by its abstraction from the gas the illuminating power of the last is sensibly decreased.

Benzerythrene, the last substance on our list, is very little known, and has scarcely yet been studied. It is the very last product in distilling pitch, and may thus be separated without difficulty. It is of a resinous character. After nearly all the oil with the hydrocarbons has passed over, this last product appears in the form of a bright red powdery vapour. It soon loses its fine colour on exposure to light, and assumes a dull brown colour.

Another substance has been separated from crude anthracene by Graebe and Caro, which they have named *Acridine* $C_{13}H_9N$, and which is therefore a base containing nitrogen. This is remarkable for its intensely irritating action upon the skin and mucous membrane. The least particle of the dust inhaled produces most violent sneezing. Although it is present only in very minute quantities, it often is the cause of great annoyance to the workmen.

I now return to that point of my first diagram where the tar is separated into oil and pitch. Finding that the anthracene passes over just at the last moment of the distillation, it was natural to assume that more might be left behind which could be separated on continuing or renewing the distillation. Many suggestions have been made to carry out this idea of obtaining anthracene in such manner, but without destroying the pitch or without coking it, and they all appear to have been made without being verified by practical experiment.

Professor Kopp, whose contributions to the history of anthracene I have already mentioned, was, perhaps, the first to propose to melt pitch in a suitable vessel, and to carry off the anthracene vapours by introducing superheated steam or air. Now, it is well known what will happen in either case. The least trace of water is the great trouble in distilling tar or pitch, because it makes the whole mass froth up and run over into the condensing-pipes, and this will surely happen on blowing superheated steam into molten pitch. So also with introducing a current of air into the hot mass, which will result in another slight inconvenience—it is sure to set fire to the contents of the still, and to cause an explosion. This Professor Kopp seems to have foreseen himself, because he recommends us to deprive the air of its oxygen by passing it through red-hot iron tubes filled with charcoal.

But the object of these operations is to save the pitch which shall remain sufficiently fluid to run out of the still at the end of the operation.

The late Professor Calvert, who most successfully pursued scientific investigation and its practical application—and who, I believe, was the first to speak of the very subject of my paper in this room, in one of his Cantor lectures—expressed his opinion in the following words, at Manchester: "I am aware that it has been proposed to distil soft pitch so as to obtain the volatile products that are given off in coking; but the expense, difficulty, and danger of such operations are such that I doubt if they can be overcome so as to produce anthracene of comparative purity on a commercial scale."

These remarks, I think, must refer to Professor Kopp's suggestions, and in that respect they are no doubt most applicable.

The records of the Patent Office bear witness to a good deal of activity in this direction. The first patent was taken out by Broenner and Gutzkow. The principal claim of this patent is the process of converting anthracene into alizarine, but they also claim the production of anthracene from pitch by the very process I have just described—viz., by passing steam into the still.

The next patent was taken out by Mr. Henry Fenner and myself, and we were the first to distinctly claim the production of anthracene from coal-tar pitch, either as a continuous process of the tar distillation, or a separate operation, but in all cases we continue the distillation to the complete coking of the pitch; we also were the first to practically carry out this process, and to obtain thereby anthracene on a large scale. This patent, like every other patent which is worth anything, has been made the subject of a good deal of discussion. First, it was asserted that everybody had done exactly the same thing long before; then it became quite evident the thing could not be done at all; lastly, it might possibly be done, but to no purpose.

(*To be continued.*)

THE PYROPHONE.

A novel and very remarkable musical instrument has recently been invented by M. F. Kastner, of Paris, which, it is said, produces astonishing effects even in the midst of the largest orchestras. It is termed by its inventor the pyrophone. The origin of the device is due to the curious discovery made by M. Kastner in the properties of singing flames. Many scientific men have studied these interesting phenomena, but the peculiarities of two flames in conjunction seem to have escaped their notice. As a result of his investigation, M. Kastner finds that if, in a tube of glass or other suitable material, two or more isolated flames of proper size be introduced and located at a point corresponding to one-third the length of the tube, reckoning from the base, such flames will vibrate in unison. The phenomenon continues as long as the flames remain separate, but the sound ceases the instant they are brought in contact.

The pyrophone, at first sight, resembles an organ; but instead of being operated by air blown in, it produces its notes by the singing of the flames within the tubes, the quality of the sound, its pitch, and intensity depending, of course, on the dimensions of the latter. The burners from which the flames emerge are so arranged that the flames run together, but may be separated instantly by pressing down a key on an ordinary key-board in front. The position of the key in relation to the sound is the same as upon the piano or organ. According to the law above cited, as soon as a key is pressed the separated flames in the corresponding tube give forth a note, continuing, as in the organ, as long as the key is held down. It is said that the music thus produced is extremely beautiful, and that the sound closely resembles, in delicacy and purity, that of the human voice. The invention was patented in England last year (No. 1091), and is thus described in the specification:—

The construction of this new or improved musical instrument, named the pyrophone, is based upon the musical instrument known as the chemical harmonica.

It is well known that when a pure hydrogen gas-jet burns in a glass or china tube, or other vibrating material, a pleasant soft tone or sound is produced. The characteristic novelty of this improved instrument consists in the construction of the burners, and in the combined apparatus employed to act on these burners by means of the touch on the keys, similar to an ordinary piano, in order to obtain the sound or note required, or to stop it as required.

The burners are constructed with double oscillating branches or arms, in such manner that the two jets are brought into one by the contact of the two branches, whilst at the moment the sound or note is produced the two branches are separated, and form two distinct jets, which produce the vibration in the glass, china, or other tube which surrounds the branches of each jet or burner.

The improvements in the construction of the pyrophone consist—1. In dispensing with the inlet-cock for the gas. 2. In the means employed for dispensing with the two cocks heretofore employed for regulating the passage of the gas to the two branches of each tube. 3. In a more simple arrangement of mechanism for transmitting the movement of each key to its two corresponding branches.

GASLIGHT ASSOCIATION OF THE UNITED STATES.

Meeting at Cleveland, Ohio, Thursday, May 14.

(*Continued from page* 203.)

After a long conversation it was decided to hold the next annual meeting in the city of Brooklyn, N.Y., and arrangements were made for the publication of the transactions of the association.

Mr. Hague introduced the subject of cement and leaden joints, and asked for information on their comparative value, from any member who had had experience thereon.

Mr. Walker said he used lead in all underground work, but for all joints throughout the works, from the first joint above the retorts until he passed the meter and got underground to the gasholder, he used cement. It was ordinary cement (water lime), also Portland cement, and he found, from the way he made the joints, they were perfectly secure. He objected to using cement underground, as there was no chance for expansion and contraction. In making cement joints, he first put in sufficient packing to prevent the cement running into the pipe, then, putting on a clay roll, the same as if making a lead joint, poured in the cement, allowed it to set a little, then removed the clay, and finished with a trowel. He had found this method satisfactory on all joints around the works. In making joints on the hydraulic main he used trunk board packing soaked in cement, and this was the easiest and best joint he ever made. But underground, where pipes were exposed to such variations of temperature as they had in the north, and where pipes were apt to be moved by filling trenches, he objected to the use of cement, for the reason that the joint would break with the least movement before it was thoroughly set. He had found in some instances that the pipes were parted a quarter of an inch, and without depression, showing clearly to his mind that the break was caused by contraction. He had found some during last spring in that condition. If the temperature was more uniform this would not be likely to occur.

Mr. Hyde said he used Roman cement around the works, and lead in the streets. There was not much difference in the cost.

The President said some gentlemen were accustomed to use Roman cement underground, and he should like to hear their experience.

Mr. Hague said he had laid five miles of pipes with Roman cement, and had had some broken mains. Probably if he had used lead they would have been in the same condition. His experience with Roman cement was satisfactory.

Mr. Dwight said he had 27 miles of pipe laid down with Portland cement joints. The soil was good for the purpose—a loam sand—and his leakage was 5 per cent. in street-mains. He had never any difficulty with this description of joint when well made. He used Portland cement all round the works in every place that could be conveniently got at, and in close places he used a lead joint. He used two packings in making cement joints. The mains were laid at an average depth of 3 feet. He had had frost down below, but, in the course of 15 years, only two mains throughout the whole city had been broken—the joints had never broken. The cause of breakage in the two cases referred to was the settling of the ground; there was no contraction or expansion.

Mr. Nettleton said he used Roman cement in laying some seven or eight miles of pipe, and in the cold weather, a year ago, in two places, the pipes were drawn right apart from contraction. He therefore determined to make no more cement joints under ground, and had used lead from that time forward.

Mr. Walker said he had two pipes break from precisely the same cause. The pipes were 2½ feet below ground. The mains were not broken by the settling of the ground—they were on solid ground and parted as Mr. Nettleton said.

Mr. Nettleton observed that the difference between Roman and Portland cement was this—the former set a little quicker than the latter—but the essential elements of both were the same.

Mr. Dwight, in reply to the president, said his leakage from street-mains was only 5 per cent. His yield of gas per pound of coal averaged 4·60 to 4·70 feet. He had no means of knowing how many thousand feet of gas he lost per

month per mile of main. In reply to Mr. Robinson, he said he used Portland cement for joints quite pure, and without admixture of sand.

Mr. Robinson said he had used Roman cement for joints. His pipes were laid at the uniform depth of 3 feet. The soil was gravelly and solid, and the joints, when examined, were generally found to be perfectly tight. The first few miles of pipes that were laid at Columbus, by the contractor who erected the works, were laid with lead, and at the time the mixed pavement was laid over the principal streets, those joints were dug down to, examined and tightened, and cement put on. It was found that a great many of the lead joints were leaking, as was shown by the discoloration of the earth around the joint; and, by that examination, they came to the conclusion that the cement joint answered best. They had had Roman cement, with which they could mix from one-third to one-half pure lake sand. It would set quick enough, and would do just as well; but they could not use anything but the purest lake sand.

Mr. Walker said there was one objection to using sand, the tendency being that the joint might become porous.

Mr. Robinson said that was the objection to the sand in the vicinity, but the lake sand they could use.

Mr. Littlehales remarked that there was another question, that of wooden pipes, in which he felt a great deal of interest; and if any member had had any experience with them for any length of time, it would be to the advantage of the association if he would state the results he had gained. He (Mr. Littlehales) laid a short distance of it in Hamilton, as a matter of experiment—about a mile and a half, or something like that—and, he believed, so far it was perfectly tight; but, as to durability, that remained to be proved. He understood that in a number of towns in the States a quantity of wooden pipe had been laid, and some gentlemen present might have experience on the subject. If wooden pipes were a success, gas-works could be constructed at a very much less cost.

Mr. Spencer said he had had a little experience in the use of both lead and cement. He used lead formerly and cement for the last two years; and while Mr. Nettleton had had pipes broken square off with cement joints, he had not had; hence he did not think it would do to come to a conclusion from any one experience in regard to these things. He had laid perhaps 1½ or 2 miles of pipe, part with Roman and part with Portland cement, and most of it was laid before the excessive cold weather of a year or so ago. It was all gone over this spring, and only one or two leaks were found in the whole of it, where the joints were used up, the rest remaining intact even in their cold climate.

Mr. Walker said he had had very little experience in using wooden pipe; but he had seen a good deal of it used, and the objections to its use that he had were, that any material used for the conveyance of gas from the works to the burners, that required any gum or resin that naphtha would dissolve to make it gas-tight, was unfit to be used for that purpose, as whenever the gas reached this material it would dissolve it, and a leak might follow, and the dissolved tar or asphaltum cement, with which the pipes were coated, when dissolved would flow to the drips, and render it impossible to pump them. He had also had this experience with cast-iron pipes that were coated with this cement. The tar being in the joints, it was supposed that pouring the lead in very hot would clean it out; it did not do it, and although the pipes were tested with water, and stood a pressure of 40 pounds to the square inch, yet the tar in the joints dissolved and ran out, and in a little more than a year they had all to be gone over again. In the north-west, where he came from, two or three companies used tamarack logs, and he certainly would prefer that to the manufactured pipe. They laid those tamarack logs in a soil that was wet all the time, which was greatly in its favour; and they claimed very little leakage from them.

Mr. Severance referring to a question put by Mr. Coombs, of Youngstown, said it seemed to him a very important point what was the leakage per mile in pipes with cemented joints. His own experience, which did not amount to much, was that with the use of Roman cement joints he had found a good many leakages, but by the advice of Mr. Hyde he had gone over the ground and examined the joints with a steel bar, casting it down into the ground, and with a light had very soon found out whether there was gas in the neighbourhood. He had pursued this course twice a year, and found it pay.

Mr. Littlehales said he should like to say one word about this mode of discovering leakage. He would not do it on any consideration, for the reason that some parts of the pipe might be very thin, and if a bar was put on to one of those parts, the result would be that instead of discovering the leakage you would make it. There was great danger arising from the use of that method, and he would caution members to be very careful about it.

Mr. Walker said he had used the same kind of a bar for 16 or 18 years, and never had punched a hole in a pipe, and he could find the smallest hole in the street anywhere.

The President said an extraordinary statement had been made to him by a member of the Convention. This gentleman was running a small gas-works in that State, and his information was to the effect that he used no exhausters, ran without a dip, without a seal, and had not been obliged to clean his retorts for three years.

Mr. White said he would give the gentleman 50,000 dols. if he would come down to Brooklyn and teach him how to do that.

Mr. Reinmund, the member referred to, said: In running these one-horse works we are deprived of the talent of experienced engineers; we cannot afford to have them—at least our company think so; and we have to work as best we may. Our works were started on the old plan of hydraulic main, and I found, when we commenced using clay retorts, that about every two months we had to lay off for scurfing out, and in small works it was no trifling matter to lose the use of a retort. I determined upon a plan of my own to dispense with the hydraulic main. It is a moveable seal attached to the bridge-pipe. Now, I state facts, and do not wish to be catechized; I am not prepared to be catechized. This last fall I shut down two benches of clay retorts; before doing so I remarked to the superintendent that some of my neighbours had insinuated that I was using coal that did not have sufficient carbon in it to cause an incrustation of the retorts, therefore I got rid of the trouble. Now, said I, Mr. King, let us test this. You leave this one bench under seal, and work the other without a seal, and in six weeks I could not have run 100 lbs. of coals, whereas the other run 200 lbs. each charge, right straight along. Those retorts were used—one bench nearly three years, and the other a little over two years, and I pledge my word there never was any carbon collected upon any of them.

The President: Describe your system.

Mr. Reinmund: My system is making a dip in the bridge-pipe, between the stand-pipe and the point where the hydraulic main should be. There is a dip in the pipe instead of making a bridge there; there is a dropper, and then there is an outside bucket that is governed by a lever. I have seen a plan in Eastern Pennsylvania that has an inside arrangement that leaves the bucket above. This of mine is an outside jacket. When the charge is being drawn the stoker raises the bucket, and this seal in the bridge-pipe prevents it going back; and if, in charging, or after having let up, he should neglect to unseal it, it will work just the same as the hydraulic main works; but the object is to let the bucket down and give free flow to the gas without its coming in contact with any liquor at all. Use no exhauster, and the pressure-gauge stands at about 2½.

The President: Have you any gauges between the retorts and the rest of your bridges?

Mr. Reinmund: I had a gauge there that broke a short time ago.

The President: Will you state what your results were?

Mr. Reinmund: Our yield is about 4·25 feet of gas per pound of coal. We are using a coal that is not generally known as a gas coal. It is a new field in Perry county, close to our place—Straitsville coal. I do not know what, under proper treatment, that coal would yield.

The President: It produces about 3·80 feet per lb. at Columbus.

Mr. Reinmund: I may say that I was the first that used that coal, and I corresponded with Mr. Douty, of Columbus, in regard to it. One of the proprietors of the coal company said to me, "You have introduced our coal in Columbus."

The President: I would say that Mr. Douty told me two years ago, soon after using the Straitsville coal, that the yield was about 3·80.

Mr. Miller: I would state that I have just finished, having a pressure of 28·10, and on a test I made with this Straitsville coal I got just exactly 3·50, and I do not believe his yield has been over 3·50.

The President: This is a coal which is especially used in blast furnaces; of course there is not so much bitumen in it, so if our friend gets 4·25, it is an extraordinary testimony to the vacuum process.

Mr. M'Ilhenny: I am really disappointed at the very strong endorsements of the theory that I presented yesterday. My friend here says that, without an exhauster, he gets more astonishing results than I had any reason for anticipating, and I think every person that I have heard speak on the subject has testified that the theory I have advanced is the correct one.

Mr. Miller: Mr. Walker has spoken to me in regard to carbon. I am using what is called "Douty's Patent Dip-pipe," the same principle as that of the moveable seal, and I find in my retorts more or less carbon. In this retort seal attached to these test works, I find it quite different from what Mr. M'Ilhenny states. I find it on the dip in quite large formations.

Mr. Severance (to Mr. Reinmund): You say you make 4·25 feet per lb. What amount of gas will the meter show?

Mr. Reinmund: I do not think my answer in regard to that would be any criterion at all, for the reason that, from the very starting of our works, our street-main has been leaking, and our loss has been about 25 per cent.

Mr. Nettleton: Has your loss been more or less since you worked in this way?

Mr. Reinmund: Our loss has been less. I have for the last six years put down nothing but wooden pipe, and our loss has been less, although our main has been extended some three miles.

Mr. Walker: The question under discussion was the collection of carbon on retorts.

The President: As connected with running without a seal.

Mr. Walker: I was about to suggest that I have, in my experience with clay retorts, which extends over some 18 years in this country, found retorts that collected much more carbon in them than others. I do not know what kind of a retort the gentleman uses. I do not want to ask him, and I do not want to tell anything about the kind I use, because I do not want to advertise anybody's property; but I was going to tell you, in speaking of running retorts, of one or two instances where they run just one retort. They are 30 by 15, and they needed just about what they would make; and the reason they run one retort is that they did not need to save coke in winter time to run with in summer. They make about 8000 cubic feet in that one retort 15 by 30, and 8 to 9 feet long. They have no trouble in keeping it clean to make all the gas they want. They are in the habit of laying off on the Sabbath, as near as can be done, the 24 hours; and I believe that bugbear of carbon—I know it is an awful bugbear to some—I think resting on the Sabbath has something to do with my not having so much trouble with carbon. I am not speaking with reference to the moral side of the question; that is a different thing. I mean that by working six days of the week instead of seven that I loosen the carbon, and it comes off very easily. For that reason I am not troubled nearly so much with carbon as other gentlemen; and, besides, my men are better, and I get better work out of them, and I do not know but I can make as much gas in six days as some people do in seven, and do it as easily. The men are anxious to get the Sabbath, and work better during the week.

Mr. Steele: Do you make less carbon in the six days than you do if you work on Sundays?

Mr. Walker: I do not attribute it to that, but it is because the retort lays off that I am not troubled with carbon, and my yearly results prove that I do about as well as anybody else.

Mr. Sherman: Do you not lie idle for the purpose of removing carbon?

Mr. Walker: We do occasionally; but it is no trouble at all.

Mr. M'Ilhenny: Mr. President, I am glad Mr. Walker has made the statement that he has. The impression has prevailed from the commencement of his statement that he did not have any carbon; but, from the statement that he has just now made, that his retorts are idle 14 per cent. of the entire time, one day in seven his retorts are idle. That embraces 14 per cent. of the entire year that he makes nothing from his retorts, and he says he has a considerable quantity of carbon every six days. Otherwise he has no means of getting rid of the carbon; it accumulates, and the only reason he does not have it in large quantities is because he frequently removes it.

Mr. Walker: That is the idea exactly.

Mr. M'Ilhenny: Fourteen per cent. of the time lost.

Mr. Walker: That is very clear. Fourteen per cent. of the time, if I can so manage it, I do not make gas—as near that as possible. But you can go to any place where that system is practised—go to Hartford, Connecticut, during the years I had charge of the works there—and see whether they did not realize results equal to that of any other works where the seven days of the week are worked; and I am prepared to show what I am still doing, and I can name other works where I have partially introduced that system of working. In Hartford, Connecticut, I was visited by some gentlemen from, I think, Massachusetts; and they considered that I made quite as much gas in six days as they did in seven. The physical condition of my men is better, and they do more work if they rest on the Sabbath day.

Mr. Hague: I have tried that plan 20 years, and I fully endorse every word Mr. Walker has said in reference to Sunday work.

Mr. Littlehales: This subject was brought up before the British Association. I believe all were anxious to abolish Sunday labour, and the London engineers agreed to give every possible chance to the effort to do away with it, and they did. I will tell you what the result was. Before six weeks had elapsed, in the Crystal Palace works every one of the men asked to be permitted to go on with the work. Why? They stopped on Saturday night, and let their fires go down; when they came to take out the clinker about three hours were gone, and they were nearly exhausted. They found it was much harder on them by working that system, and they unanimously asked to be allowed to go on with the work as usual, for the reason that there was less strain upon them by doing it that way than by letting the fires go down. Another objection: The charge being left in the retorts some considerable length of time, a large amount of carbonic oxide gas was given off, all the inferior parts of the gas carbonized into a sulphur compound, and all the retorts had to be charged at once; and then, if you do not do that—if you only charge a part of them, and leave a part of them for the next charge—there is a portion standing idle, so they gave it up; and, I believe, in no one of the London works that I am aware of do they work in this manner; and, so far as the labourers are concerned, I believe the unanimous opinion is they can work more economically, with less strain upon the men, by giving each man every third or fourth Saturday, but keeping the fires going regularly at the same time.

Mr. Walker: I am sorry to hear the gentleman tell us they have returned to Sunday labour in London because it was more profitable; but, in his concluding remarks, he has proved that rest to the men is profitable. If it is a question of profit and loss, the yearly results will determine that very clearly.

Mr. Littlehales says that the men were dreadfully fatigued in cleaning the fires after they laid over the Sabbath. I must say I never had a complaint of that kind from any of my men, and have never heard them express any desire to return to Sabbath labour. I think, on the other hand, I can get my men to work for less pay than is given in other places where they work seven days in the week. I have had no trouble, and, in reference to cleaning the fire, there is no clinker-making during the entire time of laying off. The dampers are closed, and there is a man in charge, whose business it is to see that the fires do not go down. I simply slack the lids to allow the gas to escape, so that there will not be much chance for air to enter, and let the coke remain there till we are ready to charge again. With regard to the profit and loss of the matter, I refer you to the president of our works, and to all the works I have been connected with, where the system of doing away with Sunday labour has been practised.

Mr. Littlehales: I would simply say that the London people have given it up at the special request of the men. To my own knowledge they came in a body to the engineer and asked it.

Mr. Hague: There is another reason why those men should come in a body and make that request. I am now and have been engaged in running certain oil-wells, and, as a general thing in the oil regions, they run the seven days of the week. I never have run mine more than six. My men came to me one day, saying, "These wells are being spoiled by shutting down Saturday nights." "Let them spoil," I said. Said they: "We don't want to run a well that is being spoiled." I told them to go and get another job. The fact is, they wanted seven days pay, and I would not give but six. My wells to-day are the longest lived in the region, and I attribute it to that fact. I have better men—men that would not work Sundays if I wanted them to.

Mr. Littlehales: Mr. Walker speaks in regard to the lids being slacked when the charge is worked off, and wonders that the London men had not thought of this; but I think they would not slack their lids if they knew that by so doing they would crack the retorts, and that is one reason, in using clay retorts, why they do not do so.

Mr. Walker: That is a mistake entirely. I again desire, gentlemen, to look at the yearly results in works that have been run in this way, in regard to that point, if the retorts cracked. The yield would be very small, and the life of the retorts very short. The only difficulty I have found is, when my retorts have been running three or four years, even five years. In one place I made about 5 million cubic feet per retort.

Mr. Hickenlooper: Would there be any change in the temperature of the retort?

Mr. Walker: The temperature is higher owing to the coke being left in.

Mr. M'Ilhenny: I regard this question of Sabbath labour as one of considerable importance. Every one who has had a religious education feels inclined to respect that day; but there is an insurmountable difficulty in the way, especially in large cities. We all know that the consumption of gas is very heavy on Saturday night, and, without a very large amount of storeage room, it would be almost impossible to keep up with the consumption without working on Sunday. That is the only objection I see to the system, otherwise I think it is very feasible; and if it could be adopted it would be preferable to the present system of working seven days in the week. The great consumption in the large cities could not be provided for except by having an excessive amount of storeage room. We all know that no matter how well you guard the amount of consumption and supply there are times when we will be caught, and that time might be on Saturday night. The weather changes constantly, and, no matter how large your storeage is, you will be constantly drawing on it under circumstances over which you have no control; and, at the very time your men are supposed to stop, your supply is at the bottom. In small cities I do not see that these difficulties will occur, and I think that the system of resting over one day in the week is a good one.

Mr. Walker said he would do the best he could. He remarked that, as many gentlemen would have an opportunity of going to Hartford, they might examine the company's books during the five years he was in charge of those works, which he carried on upon that system. During that time he had not very extensive storeage. He might also state that he never changed the pay of the men; and when in a neighbouring city, two years ago, the men demanded 75 cents. more per day, and when there was a great deal of trouble with strikes in New York, his men were perfectly satisfied with five dollars a month more—*i. e.*, with an increase from 45 to 50 dollars a month.

Mr. White was requested to prepare a paper on "Naphtha Gas," and Mr. Price a paper on "Coal," for the next meeting; and Mr. Nettleton promised a paper by his son, Mr. C. H. Nettleton, of Derby, Connecticut, on "Leakage; or, Unaccounted-for Gas," Mr. Hyde also promised an article on "Purification."

The convention then adjourned.

Blackburn Water-Works Company.—The half-yearly meeting of shareholders was held on the 10th inst.—Mr. T. Dugdale in the chair. The secretary (Mr. Whitehead) having read the notice convening the meeting, the accounts for the six months ending June 30 were submitted. The chairman, in moving their adoption, said there had been no change in the amount of share capital entitled to dividend, but £955 had been received on capital account, being £705 in advance of calls, and £250 on mortgage, and £45 10s. 1d. has been expended in extending the mains, leaving a balance of £4003 1s. 7d. expended on capital account more than had been received. All the profits on fittings for the half year had been added to the reserve-fund, which now amounted to £2018 5s. 10d. The rainfall during the half year had been—At Pickupbank, 17·6 inches; Guide, 16·1 inches; Blackburn, 16·6 inches. The rainfall for the corresponding half of 1873 was—At Pickupbank, 17·2 in.; Guide, 17·1 inches; Blackburn, 16·6 inches. During the months of May and June, 1873, there were 6 inches at Pickupbank, and 5·7 at Guide, but during the months of May and June this year there were only about 2 inches, and that at various times when the land was dry. The directors had not restricted the proper supply of water to their customers, but had prosecuted several for wasting water, and had now about two months supply. They had supplied upwards of 7000 houses with water since the last Act was obtained in 1861, in addition to a large quantity for business purposes, and they had parliamentary authority for taking water from about 1400 acres of land, which had not been utilized for bringing water to the town. They purposed applying to Parliament for additional capital to enable them to make that gathering-ground available for bringing water to the town. During the half year, 184 yards of iron mains had been laid down, making the total length 57 miles and 409 yards; 165 houses had been supplied with water, making the total number 18,444, and 14 meters had been fixed for supplying water for business purposes, which had increased the number to 306. The amount of water-rents for the half year was £6961 8s. 2d., which was a decrease of £148 17s. 6d., compared with the half-year ending December, 1873, but an increase of £206 5s. 1d. compared with the half year ending June, 1873. The amount of water-rents for domestic purposes was £4965 6s. 3d., which was an increase of £79 19s. 11d. over the half year ending December last, and the amount for business purposes was £1996 1s. 11d., which was £227 17s. 5d. less than for the December half year. The amount of net revenue would enable the meeting to declare a dividend at the rate of 8½ per cent. per annum, and to carry forward £79 0s. 10d. to the current half year. The motion for the adoption of the report was carried unanimously, the dividends declared, and a vote of thanks given to the directors. The chairman, in acknowledging the vote, said this was the 59th half-yearly meeting of the company, and it had been his pleasure to preside at every one.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(from our own correspondent.)

The iron trade continues to improve slowly, and the prospects of future business are decidedly more encouraging. The demand for sheets shows increasing steadiness, the fall of 20s. per ton on the best qualities, which was announced a week ago, has had a good effect upon the market, by bringing out orders which had for some time been withheld in the hope of lower quotations, and it is reported that most of the mills are now in fairly sustained operation, and that one or two are really busy. The decline in the prices of best sheets has not materially affected the medium and common qualities, nor can any further reduction on these be expected until the manufacturers obtain relief in the way of cheaper fuel. The pig iron trade is still flat; but the improved demand for finished iron must soon affect this branch, seeing that stocks are low at nearly all the mills and forges; but Cleveland, Derbyshire, the Forest of Dean and other districts are still successfully competing with local makers. The number of furnaces in blast has been raised to 50. Common cinder pigs are quoted at 60s. to 65s. per ton. All mine 110s. to 115s.

The ironfounders are busier than last reported, and are now tolerably well employed on machine and general castings, and orders for pipes for gas and water purposes are coming in more freely. Messrs. Cochrane and Co., of the Woodside Iron-Works, are now engaged on about 300 tons of pipes for the Wolverhampton Gas Company, who are extending their mains; and Messrs. Claridge and Company, Limited, of Wolverhampton, have just completed a large contract for the Corporation Water-Works.

At Wednesbury the wrought tube makers report business better, but the condition of the trade is still far from satisfactory.

In the coal trade business is still much restricted by the general belief that prices will soon be lower, and few contracts are being made at current rates. Meanwhile the pits are only in partial operation, and stocks are still accumulating; and stagnation is most severely felt in the Cannock Chase district, where household fuel is principally raised, so that winter's supplies are not yet being bought in, as is usual at this time of the year.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(from our own correspondent.)

There is no real improvement to record in the state of trade hereabouts, and few, if any, signs of an early amelioration.

One of the first steps leading to so desirable a consummation is undoubtedly a reduction in the price of coal—a drop which has already been inaugurated, and must shortly become not only general, but of considerable extent. At many of the stations and colliery sidings of this district there have been and are great stocks of coal on hand, much of it in waggons. For a large proportion of this there is no *bonâ fide* demand, consequently, seeing that the output is still going on on a considerable scale, prices must come down.

The founders are still doing pretty well. There is a moderately encouraging inquiry for foundry pig, which are held, as far as Cleveland makes are concerned, at the following figures:—No. 1, 76s.; No. 2, 72s.; No. 3, 70s.; No. 4, 65s.; No. 4, forge grey, 58s.; No. 5, forge mottled, 57s.; No. 6, forge white, 56s.; refined metal, 86s.; Kentledge, 67s. 6d.; and cinder pig, 49s.; all delivered f.o.b. in the Tees for net cash, or on corresponding terms in railway waggons. Bessemer pig is easier, but there has been no lowering of Scotch brands, which are scarce and difficult to obtain in this locality.

During the strike of colliers just ended the Manchester, Sheffield, and Lincolnshire Railway Company alone lost nearly £9000 through the cessation of the coal traffic, besides other indirect losses.

An inquiry into the water supply of Bakewell has just been held, on behalf of the Local Government Board, by Colonel Ponsonby Cox, the point investigated being the borrowing of £5500 on the security of the rates for the better supply of the town with water. The present source of supply is Ball Cross Wood, where there is a collecting-reservoir of insufficient size. The proposed source of supply is the Fallinge, near Rowsley, a distance of about 3½ miles, whence it is proposed to carry the water in 3-inch pipes to a specified point, where a reservoir would be formed, and a 5-inch main laid for the town supply, thus affording some 90,000 gallons per day. The matter was gone into at some length, but no decision has as yet been received.

IRON AND COAL TRADES OF LANCASHIRE.

(from our own correspondent.)

Although many of the leading coalowning firms continue well off for orders, trade generally is wanting in animation, and prices, especially for the secondary classes of coal, are a trifle easier. Amongst the smaller colliery proprietors there is great irregularity in prices, and the unsettled state of the market is causing consumers to be rather diffident in giving out large orders. During the past few days several large orders for cannel, although the prices quoted were slightly under current rates, have gone off, and generally throughout the trade there are at present far more sellers than buyers.

In the Manchester market there is a fair demand for coal, both for domestic and manufacturing purposes; but some very low prices are being quoted, and trade is not in a satisfactory state. The Liverpool market is quiet, and prices are rather easier.

In the Wigan, St. Helen's, and West Lancashire districts there is only a moderate business doing, and stocks are slightly on the increase. The brick-making season is now practically over, and brickmakers, who are now simply working off their stocks, are not in the market for slack. The chemical works are also not large consumers at present, but some rather heavy railway contracts have helped up trade, and there is not much disposition amongst the principal firms to make any material alteration in their quotations, and the average pit prices may be given about as under:—Arley Mine coal, 15s. to 15s. 6d. per ton; Pemberton four feet, 13s.; common house coal, 10s. to 11s.; and slack, 6s. to 7s. per ton. Cannel remains about the same, and is quoted from 30s. to 35s. per ton, according to quality; and screened gas coal, 12s. to 14s. per ton.

With regard to the reduction in wages in West Lancashire, it has been decided that 15 per cent. shall be the extent of the drop, and some such step as this has been rendered absolutely necessary by the considerable reduction in prices, which has now rendered the raising of the commoner descriptions absolutely unprofitable; but, before any final step is taken, it has been decided that an interview shall take place between representatives of the masters and the men, and this is arranged to be held in the course of the next few days.

The coke trade is still rather dull. There is a good deal of underselling in Lancashire makes, and Durham foundry coke delivered in this district has been reduced about 1s. 6d. per ton during the past few days.

In the iron trade a slight improvement continues, and, although consumers are not buying largely forward generally, a fair amount of business is being done. Foundry pig iron has shown an upward tendency during the past week, and for delivery in the Manchester district No. 1 is now quoted at 80s.; No. 3, at 80; and No. 4, at 77s. per ton. Several large parcels of forge iron have been sold during the last few days at 2s. or 3s. a ton higher than could have been realized at any time during the past two months, and this description of iron is now worth from 67s. to 70s. per ton delivered. There has been a little more doing in manufactured iron, but the works, although generally busy, are only employed on very short-date orders, and there is not much in hand for the future. Prices are not materially altered from those last quoted.

COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England has continued in a somewhat depressed state, more especially the gas and manufacturing coal trades, in which little has been doing within the past ten days. The wages difficulty between the coalowners and the miners has not had much effect upon the trade. If anything, there have been fewer orders in the market, and merchants are holding back no doubt, with an expectation that, if wages are reduced, coals will have to be lowered. The wages question will come under discussion this week. No one has any idea that it will cause any embarrassment to trade. As we stated last week, there is a general impression that the point will be compromised, and that there will be another general reduction of 10 per cent. upon wages. At present, on account of harvesting operations, there is not much business doing in the gas coal trade with the small ports on the east coast and the Channel. Coasting rates generally are lower. Indeed, it may be stated that the whole tendency of coal freights is at present towards less money. Steam shipping is short of employment. They press upon sailing ships in the market, which tends to bring all classes of freights down. Coke is lower for manufacturing purposes, with little demand. This state of the trade is making gas coke of less value than it was last year.

The iron trade of the North of England is somewhat irregular. Ironfounders are very well supplied with orders, more especially for gas and water pipes; there has consequently been an exceptional demand for foundry iron in the Cleveland district, but there is not much change in forge pig iron. Railmakers are likewise reported to be very well supplied with work, but the bar iron trade is slack. The engine-building establishments on the Tyne are very fully employed, but generally the manufacturing iron trade is not very full of work. The chemical trade of the Tyne was comparatively dull last week; prices drooped considerably. There were no inquiries from America or the Continent. It is evident that the recent "spurt" in the chemical trade of the North of England has been essentially speculative. A fairly good business is being done in fire-clay goods. The shipments of fire-bricks and retorts to the Continent have been very well kept up during the season, and still go on. Other branches of the manufacturing trade in the North are steady.

The gas-works and lands belonging to the Lanchester Gas Company, in the county of Durham, were sold by auction last week, and purchased by Mr. J. H. Little, gas engineer, Clayton Street, Newcastle.

The rains of the past fortnight have cleared away all anxiety as to the water supply of the North of England for the remainder of the summer. It was in a somewhat critical state in June and July, especially in one or two of the large manufacturing and mining districts. The flourishing undertaking, the Sunderland and South Shields Water-Works Company, seem to have an unlimited supply of water at their command, and they are extending their operations considerably.

SHREWSBURY GAS COMPANY.—The directors of this company have given notice that from the 29th prox. the price of gas will be reduced as follows:—viz., for consumptions under 10,000 cubic feet per quarter, 3s. 9d. per 1000 feet; 10,000 and under 25,000 per quarter, 3s. 8d. per 1000 feet; 25,000 and under 50,000 per quarter, 3s. 7d. per 1000; 50,000 and under 100,000 per quarter, 3s. 6d. per 1000; 100,000 and upwards per quarter, 3s. 4d. per 1000.

BRYMBO WATER COMPANY.—At the half-yearly meeting on the 11th inst.—Mr. H. Robertson, M.P., in the chair—the accounts submitted showed a net surplus of £759, out of which the directors recommended that a dividend be declared at the rate of 8 per cent. per annum, free of income-tax, payable on the 30th of September next, carrying forward a balance of £90 4s. 7½d. The report stated that at the end of December last, 947 houses had been supplied with water, and since then 104 additional have been added to the list, making a total number of 1051.

CANNOCK GAS COMPANY.—In consequence of the increased demand for gas last season, the company are making preparations to meet the requirements of the neighbourhood. The retorts and ovens have all been reset, large purifiers erected, and a gasometer, 60 feet in diameter, is in course of construction. It is expected that by the 1st of November next the company will be able, if necessary, to supply the amount of gas consumed last year.

PONTEFRACT IN DARKNESS.—A local paper says, some time ago the corporation determined to take gas for the street-lamps by meter, and take over the lighting, &c., into their own hands. A dispute has now arisen between the corporation and the gas company regarding the charges of the gas company, and the town for several nights past has been without lights in the streets. On Saturday and Sunday week, owing to the absence of light, it was extremely dangerous, the nights being very dark. We learn that at a meeting of the corporation last week the mayor read a letter from the gas company, offering to renew the supply, leaving the price, &c., to be determined by arbitration under the Gas Clauses Amendment Act, 1871.

MANCHESTER WATER SUPPLY.—The Water-Works Committee of the Manchester Corporation last week issued advertisements, stating that, being desirous to put an end as soon as possible to any inconvenience which might arise from the intermittent supply, and being also satisfied that they might rely upon every effort being made to prevent any waste or unnecessary consumption of water, they had the satisfaction to inform the inhabitants that the constant supply of water would be resumed on and after Wednesday, the 12th inst. Five persons were summoned before the Water-Works Committee on Monday week for offences against the Water-Works Acts, of whom three were fined for connecting without permission, one for obtaining water illegally, and one for wasting water.

NEWPORT (MONMOUTHSHIRE) GAS COMPANY.—At the half-yearly meeting of this company, held on the 10th inst.—Mr. Gratrex in the chair—the directors report stated that the extensions and additions to the works referred to in the last report were progressing satisfactorily, and were in a forward state. The purifiers, condensers, and scrubbers would be completed before the coming winter. Further additional works would be proceeded with at an early period, which, with the extensions now in progress, would meet the increasing demand for gas for some years to come. Mr. Bryan, who had been in the employ of the company for some years, having resigned, Mr. T. Canning had been appointed engineer as his successor. The directors recommended the payment of the usual dividends—viz., at the rate of 5 per cent. on class A shares, and 3¾ per cent. on class B shares, for the half year ending the 30th of June, 1874. The report was adopted, the retiring directors and auditor re-elected, and the usual complimentary votes of thanks were passed to the chairman and board of directors for their past services.

GAINSBOROUGH GAS SUPPLY.—We stated in our last number that the clerk of the Board of Health had been instructed to write to the gas company in order to ascertain whether they would sell their undertaking, and, if so, upon what terms. At the meeting of the board on the 8th inst., the clerk reported that he had received a letter from Mr. Bee, secretary of the gas company, stating in reply that the directors were in no way anxious to sell the works, but did not wish to throw any reasonable obstacle in the way. The directors did not feel authorized to make a definite offer without first having the sanction of a special general meeting of the proprietors, but suggested that the two corporations should confer together on the subject without prejudice to the rights and interests of either party, and if an approximation of the terms of purchase could be arranged, then the directors would submit the same to their proprietors, with a real desire to make an equitable arrangement. After a discussion it was resolved—"That a committee be appointed to confer with the directors on the subject, without prejudice to the rights and interests of either party."

SCOTCH GAS UNDERTAKINGS.—At the recent meeting of the Forfar Gas Corporation, the annual balance-sheet was laid on the table. It showed that the ordinary revenue, including a balance from last year of £572 14s. 4d., £5045 5s. 9½d., and £146 8s. 6d. from the sale of residual products, amounted to £6012 19s. 0½d.; and the expenditure, including £2827 2s. 11d. for coals, to £5094 2s. 11½d., thus leaving a balance of free revenue amounting to £918 16s. 1d. The general balance-sheet showed the charge to be £1979 19s., and the discharge £1679 0s. 4d., with a balance in the bank of £300 18s. 8d. The clerk explained that the total balance for the year was £1003 9s. 1d., as a deficiency of £84 13s., with which they began the year, had been paid off. A motion was made to dispense with the usual dinner, on the ground that it was illegal to spend the money of the corporation for such a purpose, but the motion was negatived by a majority of one. It was agreed to limit the cost of the dinner to £10. A *plébiscite* has just been taken at Dumfries on the question whether the Police Commissioners should apply to Parliament for powers to acquire the gas-works. When the votes were counted, it was found that only about 500, or less than half the constituency, had voted, and of these a majority of 16 answered in the affirmative. The Campbeltown Gaslight Company have reduced the price of gas from 9s. 2d. to 8s. 4d. per 1000 cubic feet, with a further reduction of 10 per cent. for prompt cash.

CAMBRIDGE WATER COMPANY.—The half-yearly meeting of shareholders was held on the 14th inst.—the Rev. Dr. Oke, chairman of the board, presiding. The directors, in their report, proposed a dividend on the consolidated stock and new £3 shares, and on the first call upon the new £2 shares for the half year ending July 6, 1874, at the rate of 8½ per cent. per annum, to be paid on the 1st day of September next, free of income-tax. The engineer and manager (Mr. Tomlinson) reported that during the past half year water from the company's works had been laid on to 98 premises, the increased rental derivable from which was £147 per annum. The total number of premises now supplied is 6062. During the last half year various improvements in the engines at the company's works had been completed, and a satisfactory result was shown in the reduction in the item of fuel, to which the alterations had greatly contributed. The general condition of the company's works was satisfactory. The chairman, in moving the adoption of the reports, said he might content himself with being as brief as the directors had been in their report, but he wished to call attention to one item in the engineer and manager's report, which showed skilful and careful management. The engines had been improved to a considerable extent, and the consequence had been a great reduction in the cost of fuel. It was also very gratifying that after the laboured investigation at Caius College, in reference to a disorder which had prevailed there, the cause was found to be in no way attributable to the water itself. The report upon that investigation was very interesting and elaborate, and it proved most clearly that no blame was attributable to the water, but was due to some constructive arrangements. He could not help calling attention also to the portrait which now hung in that room of the late Dr. Whewell. It was impossible not to remember that gentleman when they met in that room, because it was entirely owing to his suggestion that they had a great plant at Cherryhinton. His suggestion was dropped like a seed by the wayside, was picked up by a comparative stranger, and was eventually planted at Cherryhinton. The town was very much indebted to Mr. Peed for the action he had taken in the matter, in enabling them to establish a company with such a favourable issue. Mr. Haylock seconded the motion, which was adopted. The dividends recommended by the directors were declared, and the proceedings closed with a vote of thanks to the chairman.

Register of New Patents.

3848.—LAKE, W. R., Southampton Buildings, London, "*Improvements in gas-engines, and in apparatus for producing gaseous mixtures to be used in the same.*" Patent dated Nov. 25, 1873.

These improvements relate to an inexpensive form of gas-engine or prime mover driven by means of a mixture of combustible gas or vapour with air; further, to means and apparatus for mixing such combustible gas or vapour with air, and to means and apparatus for producing hydrocarbon vapour to be used for such purposes.

They consist in—1. A motive-power engine in which the explosive force of the gases is applied through the intervention of a water-piston. 2. Making the area of the gas-chamber of the engine smaller than the area of the piston. 3. A special valve for the passage of water and exploded gases. 4. The combination with a motive power gas-engine of a special gas-producing apparatus. 5. A gas-producing apparatus provided with gas outlet-valves, one of which is constantly open, and operated and regulated by a governor, while the other is intermittently opened and closed. 6. A double-seated valve for the outlet of the gas produced. 7. A valve for regulating the supply of air, open continuously, and operated by a governor.

3850.—ROBINSON, A. H., Dublin, "*Improvements in meters for measuring water or other fluids, parts of which improvements are applicable to steam and hydraulic motive-power engines.*" Provisional protection only obtained. Dated Nov. 26, 1873.

This invention has for its object a simple and effective means of measuring and indicating the quantity of water or other fluid passing through a fluid-meter. In carrying out the invention a cylinder of a given capacity is employed, through which the fluid to be measured is caused to pass. A piston is made to work in the cylinder by the pressure of the inflowing fluid, and on the outer end of the piston-rod there is fitted or formed a rack which actuates a toothed wheel or segment and weighted lever working loosely on a fixed nut, in which nut works a screw spindle which operates the valves.

3868.—PARKER, J. F., and WADE, A., Birmingham, "*Improvements in the process of and apparatus for the manufacture of coke and illuminating gas.*" Patent dated Nov. 26, 1873.

According to this invention coke-ovens are so connected with gas-retorts that the heat from the first stage of the manufacture of the coke is made to circulate about and heat the said retorts, and after air has been shut off and the combustion arrested, the unburned volatile matters given off from the coke-ovens, consisting of permanent illuminating gas, together with volatile hydrocarbon not permanently gaseous, are made to pass through the heated gas-retorts which have previously been charged with gas-making material. The volatile matters passing through the gas-retorts are resolved wholly or mainly into permanent illuminating gas, which mixes and passes off with the illuminating gas produced from the material in the retorts.

3902.—MORTON, R., Stockton-on-Tees, "*Improvements in refrigerators or apparatus for cooling liquids, parts of which improvements are also applicable to distillation, surface condensation, heating or cooling fluids, air, or gases.*" Patent dated Nov. 29, 1873.

The first part of this invention relates to certain arrangements and improvements in that class of refrigerators or apparatus in which flattened or other shaped tubes are used, and for which letters patent, No. 939, 1862, were granted to the present patentee. The improvements effected in this apparatus are chiefly constructional, and relate more particularly to matters of detail in the manufacture.

3910.—BELL, J., junior, and BELL, R., Wishaw, N.B., "*Improvements in utilizing the waste heat of materials employed in retorts, and in the apparatus or means employed therefor.*" Patent dated Nov. 29, 1873.

This invention, which relates to utilizing the waste heat of substances employed or treated in retorts (that is to say, which are subjected to destructive distillation therein) has reference especially to horizontal retorts. The means or apparatus constituting this invention consist of one or more plates or doors placed at the front part of the heating-chamber below the retort or retorts. The plates or doors may be fitted on a joint so as to be placed, when the charge of the retort is being drawn, in an inclined position, or they may be fixed in that position, so that when the charge is drawn it falls upon the inclined plate or plates, and is thereby directed to fall into the heating-chamber below the retort. In this manner the residual heat of the drawn charge is given back to the retort or retorts.

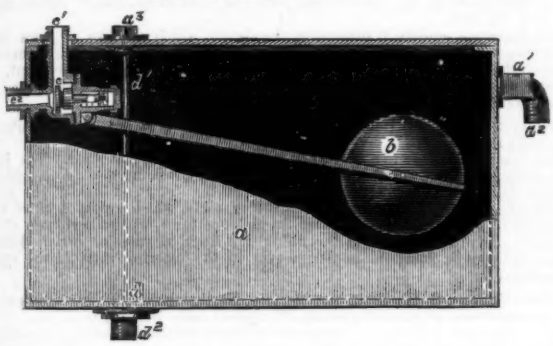
3916.—Underhay, F. G., Clerkenwell, and Carter, A. E., Notting Hill, "*Improvements in apparatus for preventing waste of water.*" Patent dated Nov. 29, 1873.

At the present time great waste of water takes place through overflow-pipes belonging to cisterns, baths, and other fittings, but such overflow-pipes are not dispensed with in consequence of the risk which might thus arise of flooding and injuring valuable property.

According to this invention the waste is prevented without involving this risk. The overflow-pipes are retained, but in place of leading them direct into a drain the patentees lead them into a box, which is sealed so that the consumer can have no access to it. Within the box is a stop-cock or valve, which is in connexion with the main service-pipe. The cock or valve is controlled by a float or by other means, so that when water enters the box the cock or valve closes.

When a cistern, bath, or other receptacle overflows, the first effect is that the box fills with water; the cock or valve on the service-pipe is thus closed, and no more water enters the house.

The box may have an overflow-pipe, so that free escape is given to the overflowing water, thereby avoiding the risk of injury to property, but when such a derangement of the water supply apparatus has taken place, no further supply will be obtained by the consumer until the box has been emptied, and this must be done by an officer having control of the water supply, and whose duty it is to see that defects in the apparatus are repaired.



The drawing shows a side view, partly in section of the apparatus: *a* is a small cistern or box, with a cover screwed on and secured by seals or otherwise, so that it cannot be opened without discovery. This cistern or box contains a ball-float, *b*, and valve, *c*, which may be of any well-known construction—a diaphragm valve is shown in the drawing. The valve is connected at c^1 with the pipe which supplies water to the premises, and at c^2 with another pipe for leading the water after it has passed the valve to the ball-cock which supplies the house cistern. The valve, as will be seen, closes when the float, *b*, is raised, and opens when it falls. The cistern or box, *a*, is also connected at a^1 with the overflow-pipe from the house cistern, and at a^2 with a waste-pipe leading into some open space, or if preferred, this connexion with the drain at a^2 may be dispensed with; *d* is a plug in the bottom of the cistern or box, *a*, which is lifted when the cistern or box has to be emptied. The plug has a handle, d^1, which can be got at only by removing a screw-plug, a^3, in the cover of the cistern or box. The plug is secured by a seal, which must be broken before the plug, *d*, can be raised from its seat. A pipe is connected at d^1 beneath the plug. It may be a short pipe leading to a spout, and serving to prevent access to the plug being had from the under side; or the pipe connected at d^1 may be led into a sink.

So long as the cistern or box, *a*, remains empty, water enters the house and passes to the ordinary ball-cock of the cistern without impediment, but should the ordinary ball-cock at any time get out of order, and as a consequence an overflow from the main cistern take place, then the close cistern or box, *a*, becomes filled, and the supply is shut off from the premises.

In place of a float it is evident that other instruments may be employed, as, for example, a counterbalanced cup, receiving into it the water entering the sealed-up box, and falling when so loaded; but the float is the instrument which we prefer to employ.

3939.—Moore, B. T., Spring Grove, Isleworth, "*Improvements in current-meters, water-meters, and ships logs.*" Patent dated Dec. 1, 1873.

The provisional specification describes employing in the first place a hollow cylindrical case, free to move about pivots at its extremities in the line of its axis. This hollow case is water-tight, and contains within itself a small framework, which carries a train of wheels. This framework is suspended from an axle, or upon pivots within the case and fixed to it, and the train of wheels is connected by an endless screw, a toothed wheel, or otherwise with the axle or pivot, or with the case, so that when the case is made to rotate, the train of wheels is set in motion, the framework remaining at rest or nearly so. Thus the number of revolutions of the case can be registered by the train of wheels within it.

3953.—Paget, F. A., Adelphi, London, "*Improvements in the mode of and apparatus for softening and purifying water.*" A communication. Patent dated Dec. 2, 1873.

The following objects are sought by this invention:—Softening water for use in towns at railway pumping-stations for locomotive steam-boilers and boilers generally, for washing establishments, for bleaching, dyeing, and soap works, and other similar purposes. Precipitating the impurities dissolved in the water by means of one or more known chemical reagents in a liquid state, and immediately separating the precipitate by means of filtering for the purposes as described, preferably at ordinary temperatures, and by the apparatus as described. Combining an adjustable apparatus for supplying the liquid reagent to the water with a mixing apparatus and a filtering apparatus. For making the solution or solutions of the reagent or reagents employed, taking water previously prepared by the process. Varying at pleasure the dose of the liquid chemical reagent or reagents by means of an adjustable apparatus such as a force-pump or a column of water regulated by a cock or valve. Mingling the liquid chemical reagent with the water by means of a special mixing apparatus. When carbonate of soda is employed to precipitate sulphate of lime, conducting a jet of steam into the mixture of the two liquids. Employing as filtering materials wood shavings mixed with small coke or clinkers or pebbles. Forming a filter of a vessel fitted with two parallel horizontal gratings at its bottom part, and above which is a wooden hoop making the joint. Applying successively two or more liquid chemical reagents by mean of two or more of the said mixers according to the quality of water to be filtered. Providing a relay by means of a series or number of filters.

3980.—Tasker, W., Halifax, "*Improved machinery for forming and welding and finishing couplings used for connecting steam, gas, and water pipes.*" A communication. Patent dated Dec. 4, 1873.

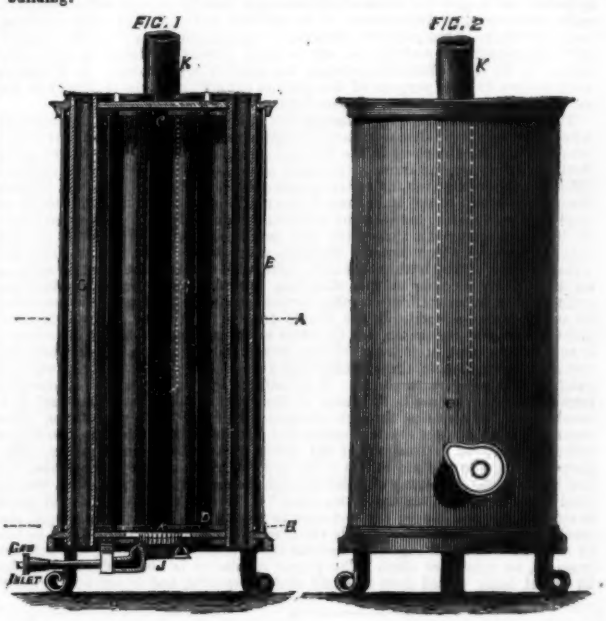
This specification describes a series of rollers arranged around a central roller or mandrel; the distance apart of the said rollers is determined by the thickness of the couplings. The outer rollers are squeezing rollers; and a guide to carry the "blank" or strip of metal is introduced into the space between the two nearest or leading rollers. The "blank" is heated to welding heat, and its end introduced between the rollers, and by rotation (imparted by gearing and suitable driving power to the rollers) it is carried around the central roller and welded by the pressure. The finished coupling is then removed from the central roller.

4001.—Messenger, T. G., Loughborough, "*Improvements in pipe-joints and in the coupings thereof.*" Patent dated Dec. 5, 1873.

Tight joints are formed by inserting at the ends where the junction is formed of a double and cylindrical metal cone piece, the conical ends being pressed closely into the ends of the flexible tubes or pipes by screwing the couplings together, which couplings may be in two or more parts, and when screwed home the joint is perfectly hermetical. For metal, glass, and other pipes and tubes, the the two ends of the pipes where the joint is to be formed are funnel shaped, and round the ends or necks of the funnels elastic washers or packings are placed; the sockets are then passed up the pipes, the orifices at the bottom of the sockets being just large enough to admit the pipes, so that when they reach the washers, and the funnel-shaped ends are brought in contact by screwing, the pressure brought to bear upon them is exercised on the washers or packings, which are consequently spread, and filling up all interstices produce a perfectly tight joint.

4038.—Cockey, H., and Cockey, F. C., Frome, "*Improvements in gas-stoves.*" Patent dated Dec. 8, 1873.

This invention has reference to the construction of gas-stoves in such a manner that the products arising from the combustion of the gas may be carried off without vitiating the atmosphere of the apartment, while the heat generated may be completely utilized by warming and causing a circulation of the air in the room in which the stove is placed, and consists in a top and bottom plate, made by preference of cast iron, and surrounded by a cylinder of sheet iron so as to form a chamber. In the top and bottom plates a number of circular openings are formed concentrically to the general axis. Into these openings tubes extending from the top to the bottom plate are inserted and fastened thereto, the tubes being open at both ends, so that the air of the room may pass freely through them. In the centre of the bottom plate an orifice is made, and within this orifice, or slightly above or below it, is placed a ring or other suitable burner, to burn either gas alone, or by preference a mixture of gas and air. At or near the middle, or by preference somewhat lower than the middle, and in one side of the outer cylinder, one end of a tube of sufficient capacity to carry off the products of combustion is introduced and closely connected therewith, the other end being led into an ordinary flue or to the exterior of the building.



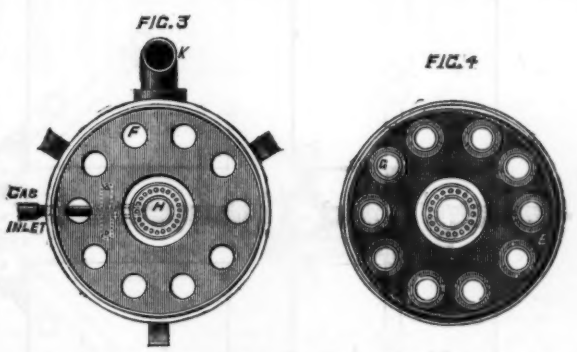


Fig. 1 is a vertical section of the stove; fig. 2, an elevation; fig. 3, a plan at B B, fig. 1; and fig. 4, a section through A A, fig. 1.

In fig. 1, C is the top and D the bottom plate; E is the cylinder of sheet iron forming the chamber; F F F, fig. 3, are the openings; and G G G, fig. 1, are the tubes inserted into these openings; H is the centre orifice; and K the exit-tube for the products of combustion.

J, the gas-burner; while

The action of the apparatus is as follows:—The gas, or gas and air, having been lighted at the burner, the hot air ascends and heats both the outer cylinder and the tubes within it; the result is that a current of cool air from the lower part of the apartment is induced to enter the tubes from the bottom, and in its passage upwards is heated thereby and afterwards diffused into the room, while the exterior cylinder assists to warm the atmosphere by simple radiation.

It will be seen that the products of combustion do not enter the room whilst imparting their heat to the tubes and cylinder, but escape through the outlet-pipe into the open air or chimney.

The form of the stove, although made circular by preference for the sake of economy, is not limited thereto, as it may be made of any suitable shape, and may be fluted, corrugated, or otherwise fashioned so as to expose a larger surface to the air, and at the same time impart an ornamental character to the apparatus.

4060.—DUPONT, L., London, "*Improvements in gas-burners.*" Provisional protection only obtained. Dated Dec. 9, 1873.

The invention consists—1. In providing a chamber below the orifice of the burner, in which the gas is detained and heated to improve its combustion. 2. In closing the annular opening around an Argand or similar burner with wire gauze to limit the admission of air, and divide it into minute streams. 3. In a mode of contracting the orifices of an Argand burner, so as to reduce the amount of metal in contact with the flame.

4088.—TURNER, W., Hanover, "*Improvements in motors to be worked by gas and air.*" Patent dated Dec. 11, 1873.

It is well known that during the combustion of certain gaseous compounds, such as atmospheric air and coal gas, the generation of heat, the development of expansive force, and the subsequent condensation of the gases, is so exceedingly rapid that it is with difficulty utilized as a motive power practicably applicable to the driving of machinery. Motive power has, however, been obtained to some extent by the production of a partial vacuum consequent upon the condensation of the gases subsequent to combustion, without regard to and without utilizing the explosive and expansive force produced by the combustion of the gases. In other cases motive power has been obtained by the explosive force alone of such gases, without regard to and without utilizing by condensation the atmospheric pressure.

This invention relates to improvements in that class of motors in which motion is obtained by a piston working in a cylinder, and propelled in one direction by the explosive and expansive force of the gas during combustion, and in the opposite direction by the pressure of the atmosphere consequent upon a partial vacuum being produced by the condensation of the gas subsequent to combustion.

The objects of the invention are—1. To utilize to a great extent the explosive and expansive forces of the gases, in addition to the pressure of the atmosphere resulting from the condensation of the gases, at the same time to prevent the noise and concussions especially at the moment of explosion of the gases (hitherto inseparable in such motors), to produce the wear and tear, and to provide for the renewal of the wearing parts without dissecting the machine. 2. To simplify the construction of the valves of such motors, whereby the possibility of setting fast by expansion or contraction is obviated, and greater facility given for releasing, examining, and cleaning the same from sediment passing from the cylinder, and to give the necessary intermittent motion to such valves without noise, concussion, or undue strain to the different parts. 3. To ensure a uniform length of stroke of the piston to completely expel the foul gas from the cylinder at the termination of each stroke, and to attain absolute certainty of firing the gases. 4. To more effectually regulate the speed of such motors. 5. To adapt such motors to the purpose of fire-engines (either portable or fixed) or for raising or forcing air, water, or other fluids.

These different objects are attained in the following manner:—1. By means of a new arrangement called a locking friction crank and grooved annular wheel arrangement, for absorbing in the first instance the power exerted by the gases during combustion, and transmitting such power, together with the atmospheric pressure, upon the piston indirectly by means of an elastic rocking beam, or other elastic connexions to the main shaft of the machine, without the intervention of cogs and tooth gearing between the piston and main shaft, as heretofore employed. 2. By constructing the slide-valve with two faces placed at an angle to each other, the one of which contains the inlet and lighting ports, and the other the exhaust ports, and by letting this slide-valve work against corresponding surfaces on the cylinder forming an open slide box, the valve being pressed against the cylinder faces by an antifriction roller turning in elastic bearings. Furthermore, by applying one eccentric for the double purpose of working of the slide valve and the lifting of the piston, and (to avoid noise and concussion) by introducing a new arrangement of locking friction crank, and grooved annular wheel for transmitting motion to the eccentric and valve in the place of the pawls and ratchets, as heretofore employed. 3. A uniform length of stroke is attained by connecting the piston-rod by means of the rocking beam (or otherwise) to a crank-wheel, which turns through a complete half circle at every stroke. The crank-pin is forced over the dead centre and returned in its path of motion at the end of the forward or up-stroke of the piston by a buffer or recoil spring. The piston coming down to the bottom of the cylinder at the end of every stroke, the foul gas must be completely expelled through the exhaust passages, which remain freely open to the atmosphere at this time. 4. The improved regulation of speed is attained by constructing the governor to operate in a direct manner upon the mechanism, which works the slide valve so as to completely control the action of the same. This arrangement obviates the necessity of throttling the exhaust passages, as heretofore done. The proper regulation is also influenced by the fly-wheel being placed upon a second shaft or spindle, and driven at a velocity greater than that of the main-shaft. 5. In motors to be adapted for purposes named under this point, the pumps are worked in connexion with and form part of the same machine. It is preferred to place them between the cylinder and the standard of the rocking beam, and to work them from an eccentric on the main-shaft.

4092.—RAMSAY, H. M., Twickenham, "*Improvements in the treatment and disposal of sewage.*" Provisional protection only obtained. Dated Dec. 12, 1873.

The object of this invention is the purification of sewage as delivered or discharged from the sewers, tanks, pumping-main, or other means, by distribution under the surface of any suitable land through a system of open half pipe or circular perforated filter-drains, laid in trenches in parallel lines about 12 feet apart, upon a bed of, and surrounded by, coarse filtering material, the trenches being filled in over to surface level.

4095.—DITCHFIELD, S. J., WATSON, G., and CHILDS, J., of Seaham Harbour, "*Improvements in the construction of heating apparatus, and in the application of hydrocarbon or other volatile oils or spirits for heating purposes and generating steam.*" Patent dated Dec. 12, 1873.

The said generators are fitted with divisions to cause the air to circulate in a serpentine manner over and through sponges to absorb the hydrocarbon or other volatile oils or spirits, which sponges are held by rings fitted half-way up between the said divisions, over which sponges a steady and regular current of compressed air is passing from the compressed air-chamber, forced thereinto by means of air-pumps; the said generators being the receivers of the required quantities of oils or spirits and atmospheric air which in it commingle, the oils or spirits being introduced by means of a supply-pipe from the store-tank containing the oils or spirits; and which said generators are encircled by a trough or a steam-jacket, filled with hot water or steam. The air thus charged passes through certain pipes fitted with throttle-valves and stop-taps into the ordinary boiler furnaces charged with coke or asbestos, which said air then ignites.

4128.—DUTY, G., Mansfield, "*Improvements in apparatus for measuring and delivering water into water-closet pans and other receptacles.*" Patent dated Dec. 16, 1873.

This invention consists in suspending the cistern, which has two or more compartments with inclined bottoms, one of which has an outlet-pipe through which the water is discharged. After passing from the first compartment, the water passes from the said pipe into a funnel-shaped top of the supply-pipe for flushing the pan.

4130.—PHILLIPS, J., Hammersmith, "*Improvements in pipe-joints.*" Patent dated Dec. 16, 1873.

This invention relates to a method of forming tight joints for pipes. The joint is of the spigot and faucet kind, the spigot and faucet being made with tapering parts fitting or nearly fitting each other at the front and back of the joint, with an annular cavity between the fitting parts, which cavity is filled with cement or fused material introduced through apertures in the periphery of the faucet. To prevent escape of the filling in, rings of yarn or other yielding material may be placed in annular grooves in the tapering parts of the spigot and faucet.

4160.—FORBES, G. H., Broughton Rectory, Northampton, "*Improvements in the manufacture of gas and quicklime.*" Patent dated Dec. 18, 1873.

This invention relates to a compound of chalk or limestone and tar, pitch, or similar bituminous substance with or without certain other ingredients hereinafter specified. This compound is designed to serve as a substitute for coal in the manufacture of gas or for making quicklime.

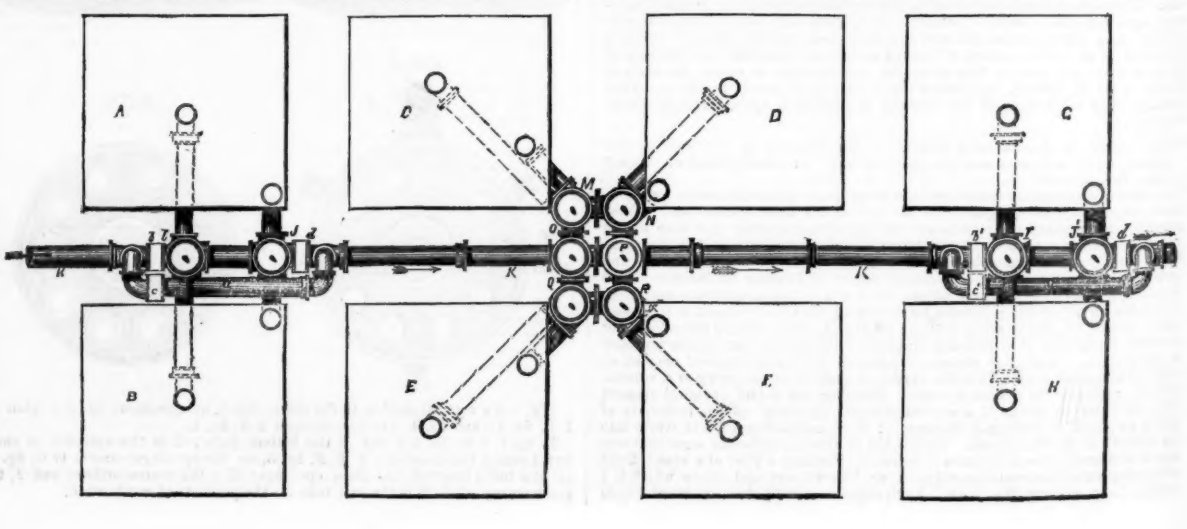
This improved compound is made as follows:—Any desired quantity of chalk or limestone is taken, and the same is combined with tar or pitch, or similar bituminous substance, or a mixture of any two or more of them. With the above ingredients a small quantity of naphtha or petroleum, or other light hydrocarbon oil or spirit, or vegetable or animal oil, or fat or fatty matter, may be incorporated or a combination of any two or more of them. This compound may be formed into blocks or pieces of any convenient size and shape; it is finally subjected to distillation in a retort for the manufacture of gas, and the residue left from the distillation forms quicklime, or the compound may be calcined simply for the manufacture of quicklime.

4163.—WALKER, W. T., Highgate, "*Improvements in and in the method of working gas-purifiers.*" Patent dated Dec. 18, 1873.

This invention relates to an improved method of working purifiers for purifying coal gas from carbonic acid, sulphur compounds, bisulphide of carbon, sulphuretted hydrogen, and other impurities.

To carry out these improvements a series of six, eight, or more purifiers is used. A series of four or five purifiers can also be partially worked, that is to say with a less perfect degree. If slide-valves were to be used for this mode of purifying, on account of the many changes which would be required in the working of the purifiers, a large number of slide-valves would be necessary, and consequently a great outlay would be incurred, besides which they would be unreliable, unmanageable, and unsafe. To avoid these objections, instead of slide-valves a combination and arrangement by preference of Walker's centre-valves and an improved arrangement of connexions are used.

Taking for example an apparatus consisting of a series of eight purifiers, as shown in the accompanying drawing, the first two purifiers, A and B, are used for purifying the gas from carbonic acid (the same having previously been charged with fresh lime), and these two first purifiers are worked either one at a time while the other is being replenished, or both together, from either one of



them into the other, for which purpose two of Walker's centre-valves, I J, with improved connexions, are employed by preference, arranged as shown.

A bye-pass is constructed for the two centre-valves and purifiers. This bye-pass consists of a pipe, *a*, and three valves, *b*, *c*, *d*, connected to the trunk main, K, and it serves to throw these two purifiers and the centre-valves out of action when required.

By these improved arrangements the working and changing of the purifiers is rendered simple, safe, and inexpensive, a large number of the mains and connexions is dispensed with, and cost and space consequently avoided.

The second part of the series of eight purifiers consists of four of the said eight purifiers—viz., C, D, E, and F, which act upon the sulphur compounds, bisulphide of carbon, sulphuretted hydrogen, and other impurities. To eliminate such impurities it is necessary to be able to work the four purifiers in several ways; for instance, to pass the gas through all of the four purifiers consecutively, through any one separately, or through two or three together. The three above stated objects are effected, and the action of the purifiers is also partially reversed by employing a combination of six by preference of Walker's improved centre-valves, M, N, O, P, Q, and R, arranged in a cluster, as shown in the drawing, such centre-valve having four ways or ports. The gas passes from the four purifiers, C, D, E, and F, into the last two purifiers, G and H, which serve as the finishing or catch purifiers, and complete the operation. As the requirements for the working of these last two purifiers, G, H, are the same as those for the first two, A, B, of the series, they are arranged in a similar manner thereto; a^1 is the pipe of the bye-pass, and b^1, c^1, d^1, the three valves of the same; I^1, J^1, the centre-valves.

The construction of the purifiers is improved by planing the surfaces of the joints or flanges of the plates composing the purifiers (instead of using cement as usual) in order to make them gas-tight and enable them to resist the action of the impurities, which on account of the purifiers remaining a long time in use when worked on the principle hereinbefore described become of a very penetrating nature, and destructive to the joints of purifiers as usually made.

4165.—HARRISON, C. W., Holborn, London, "*Improvements in the manufacture of gas, and in the apparatus employed therein.*" Provisional protection only obtained. Dated Dec. 18, 1873.

This invention consists in manufacturing gas in retorts, worked either singly or in combination of two or more, and being suitably set, by means of a pipe terminating in a perforated or porous cap. Also in the employment of a cage formed of one or more metal sifters for sifting the heavy tarry vapours from the gas.

4170.—HAAS, F., Paris "*Improvements in apparatus for heating and lighting by gas.*" Partly a communication. Provisional protection only obtained. Dated Dec. 19, 1873.

This invention consists in the construction of an improved apparatus in which certain liquids are vaporized so as to serve as gas for lighting and heating purposes. The apparatus consists of a receiver having two tubes, the upper one serving for the introduction of the air and the lower one serving for the introduction of the vapours produced by the passage of the air. The receiver and tubes are lined with an absorbing fabric. The liquid employed by preference, and which is called hydro-oxygenated carbon, is prepared by digesting petroleum, coal, schist, Boghead, or other heavy oil in chloride of calcium, and then distilling it on lime; or the liquid may be digested on soda or potash, and then on a mixture of quick lime and sulphate of iron.

4172.—AKESTER, J. C., Hull, "*An improved silica gas-stove.*" Patent dated Dec. 19, 1873.

The invention consists in utilizing the heat of gas issuing in an ignited state from Bunsen's or other suitable burners, by passing it through silica, in the form of pumice stone, enclosed in a perforated case, by which means stoves, ovens, cooking apparatus, boilers, &c., may be heated with less than half the usual consumption of gas.

4174.—HEATON, G. W., Lincoln's Inn, London, and HEATON, C., New York, "*An improved and economical method of using steam, air, gas, or other transmissible agent.*" Provisional protection only obtained. Dated Dec. 19, 1873.

The novel features consist in using high-pressure steam in single-acting open-ended cylinders exhausting such steam, not into the condenser, but into another cylinder double acting, and of such increased area that the exhaust steam is expanded to a pressure below that of the atmosphere, so that the atmospheric pressure makes the back stroke on the single cylinder, and the expanded steam from the double cylinder goes to the condenser, having exerted nearly all its expansive force.

4181.—CURIE, P., Gresham House, London, "*Improvements in the evaporation of water, such improvements being applicable to the treatment of sewage and of saline solutions.*" Provisional protection only obtained. Dated Dec. 19, 1873.

This invention consists in producing a mixture of air and hot gases suitable for the process of evaporation, such gases being obtained by the combustion of fuel, either under steam-boilers or in other furnaces. The gases so obtained are then driven or aspirated into a reservoir, in which they are mixed with a sufficient quantity of cold air to bring the whole down to any desired temperature. The mixture of air and hot gases is then blown through the liquid sewage or saline solution, and the evaporation of the water thereby rapidly effected.

4182.—FIRTH, J., and SENIOR, G. A., Halifax, "*Improvements in valves.*" Provisional protection only obtained. Dated Dec. 19, 1873.

This invention relates to valves for regulating the passage or flow of steam, gas, water, or other liquids or fluids, and is applicable for sluice, fire, blow-off, ball, equilibrium and safety valves, water-gauges, self-closing valves, and a variety of other similar purposes, and consists in mounting the valve or plug upon a finger or lever fixed to a cross shaft or spindle passing through one side of the body of the valve-box or casing, and capable of partially rotating, so as to cause the lever to oscillate, and thereby move the valve.

4192.—STRODE, W. W., MACKENZIE, J., and WILLIAMS, E. P., Osnaburgh Street, London, "*Improvements in gas-stoves.*" A communication. Patent dated Dec. 20, 1873.

The most convenient form of the stove is a cylinder having an inner and outer casing, forming an annular chamber in which the gas is burned; the heated products pass up one side and down the other to the chimney. In the front division of the annular chamber strips of metal are fixed. Across the central open cylinder wire netting is arranged, the edges being in close contact with the hot inner casing of the stove. The wire becomes a conductor of heat through which the current of cold air is obliged to pass so as to become heated. Perforated plates of metal may be substituted for the wire gauze.

Notes and Queries.

F. J. M. asks what is the average quantity of coke produced per ton of coal carbonized? Does any gas company sell one chaldron of coke to every ton of coal carbonized? What is the average per centage of coke used as fuel for heating the retorts? *A.* Referring to Mr. Field's Analysis for 1873, we find that in the metropolis the average make of coke was 35 bushels per ton of coal carbonized. The average quantity of coke used as fuel was 29 per cent. The net proceeds of coke and other residuals on the cost of the coal was 53·9 per cent.

Carbon writes: "It might be a considerable advantage to country managers, if you could give present value in London per butt (108 gallons) of ammoniacal liquor distilled to 20, 25, or 30 ounce strength."

Share List,
OF
Metropolitan Gas and Water Companies.

(*Corrected by Mr.* F. N. GOLDING, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£	GAS COMPANIES.	£ s. d.	£ s. d.	£
8000	20	Anglo-Romano	20 0 0	10 0 0	14 — 16
5000	20	Bahia (Limited)	20 0 0	3 0 0	10 — 11
1000	20	Do., preference	20 0 0	10 0 0	25 — 27
1000	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
1500	20	Do., perpetual preference	20 0 0	7 10 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	6 15 0	6¼— 6⅞
10000	5	Do., fourth issue	4 0 0	6 15 0	1—1½ pm.
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge., and Holywell.)	20 0 0	10 0 0	34 — 36
7500	20	Cagliari (Limited)	20 0 0	7 0 0	14 — 16
180000	10	*Chartered* A ordinary	10 0 0	10 0 0	16 — 16⅛
25000	10	Do. A, 5 per cent. preference	10 0 0	5 0 0	15 — 15½
20000	10	Do. A, 5 per cent. do., 2nd issue	10 0 0	5 0 0	15 — 15½
30000	10	Do. A, 5 per cent. do., 3rd issue	10 0 0	5 0 0	4¼—4½ pm.
10000	10	Do. B, 4 per cent. maximum	10 0 0	4 0 0	7 — 7½
20000	10	Do. C, 10 per cent. preference	10 0 0	10 0 0	20½— 21½
12000	25	Do. D, 10 per cent. preference	25 0 0	10 0 0	51 — 53
448875	Sk.	*Commercial*	100 0 0	10 0 0	171 —174
20000	20	Continental Union	20 0 0	8 0 0	18½— 19½
20000	20	Do., new	12 10 0	8 0 0	1½—⅝ dis.
10000	20	Do., preference (Grmny.: Strsbg. France: Cette, Nismes, Montargis Vienne, Roanne, Beaucaire, Rueil, Albi. Italy: Milan, Genoa, Parma, Modena, Alessandria, Messina.)	20 0 0	7 0 0	24 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16 — 16½
5000	10	Do., preference	10 0 0	6 0 0	11½— 12½
10000	10	Do., ordinary	10 0 0	7 0 0	12½— 13½
2500	10	Do., converted	2 0 0	10 0 0	1½— 2 pm.
2500	10	Do., converted	2 0 0	7 0 0	1 —1½ pm.
23406	10	European (Limited)	10 0 0	10 0 0	13½— 14½
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	7 10 0	10 0 0	2¼—2⅝ pm.
4054	10	Foreign and Colonial (Limited)	10 0 0	..	9 — 10
5000	10	Hong Kong (Limited)	10 0 0	10 0 0	14 — 15
1560000	10s	*Imperial*	100 0 0	10 0 0	168—170 xd
78000	12½	Do., new shares	12 10 0	7 0 0	15⅞—16¼ xd
1300	100	Do., bonds	£100	10 0 0	197 —200
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Frankfort-on-Maine, Haarlem, Stolberg, and Vienna.)	43 15 0	9 2 6	57 — 58
3000	40	*Independent*	40 0 0	10 0 0	65 — 67
3000	10	Do.	10 0 0	5 0 0	8¼— 9¼
3000	20	Do.	20 0 0	7 10 0	25 — 26
4500	10	Do., D	3 0 0	10 0 0	3 — 4 pm.
378350	Sk.	*London*	100 0 0	10 0 0	170 —172
150000	Sk.	Do., 1st preference	100 0 0	6 0 0	118 —121
14450	Sk.	Do., 2nd preference	100 0 0	6 0 0	
4350	Sk.	Do., 3rd preference	100 0 0	6 0 0	
7622	25	Do., A shares	12 10 0	6 0 0	
26805	All	Do., Debenture stock	100 0 0	5*l.* & 6*l.*	
15000	5	Malta and Mediterranean (Limited)	5 0 0	3 0 0	2 — 2½
6000	5	Do., preference	5 0 0	7 0 0	5 — 5½
20000	5	Mauritius (Limited)	2 0 0	7 0 0	2 — 2⅜
25000	20	Monte Video (Limited)	20 0 0	..	22 — 23
8000	10	Nictheroy, Brazil (Limited)	10 0 0	..	
30000	5	Oriental (Calcutta)	5 0 0	9 0 0	7 — 7½
30000	5	Do., new shares	2 10 0	9 0 0	⅞—1½ pm.
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2½
17500	10	Pará (Limited)	10 0 0	7 0 0	6 — 8
27000	20	*Phœnix*	20 0 0	10 0 0	34 — 36
360000	100	Do., new	55 0 0	7 10 0	71 — 73
144000	Sk.	Do.	100 0 0	5 0 0	93 — 95
5000	20	*Rateliff*	20 0 0	10 0 0	34 — 36
36000	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	29 — 31
7359	5	Singapore (Limited)	5 0 0	7 10 0	4½— 5
2000	5	Do., preference	5 0 0	7 10 0	5½— 6
1500	32½	Shanghai	32 10 0	12 0 0	30 — 32
4000	50	*South Metropolitan*	50 0 0	10 0 0	86 — 88
4000	12½	Do.	12 10 0	10 0 0	21 — 21⅝
20000	12½	Do., new shares	5 0 0	10 0 0	6⅛— 6⅞ pm.
15000	10	*Surrey Consumers*	10 0 0	10 0 0	16½— 17
10000	10	Do., new	7 0 0	10 0 0	5 — 6 pm.
9000	4	United General (Limerick)	4 0 0	2 10 0	2 — 2½
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	14 — 15
1500	10	Do.	10 0 0	7 10 0	11 — 12
2957	10	Do.	10 0 0	7 0 0	
993	10	Do.	3 0 0	7 0 0	
16000	5	*West Ham*	5 0 0	10 0 0	7½— 8
16000	5	Do., new shares	2 10 0	10 0 0	3 — 4
		WATER COMPANIES.			
12000	100	Chelsea	100 0 0	6 0 0	122 —124
1800000	100	East London	100 0 0	6 0 0	—125
8000	50	Grand Junction	50 0 0	7 0 0	76 — 78
5840	25	Do., ¼ shares	25 0 0	7 0 0	36½— 37½
2160	25	Do., new do.; maximum dividend, 7½ per cent.	25 0 0	7 0 0	31 — 33
4896	100	Kent	100 0 0	6 10 0	128 —130
5339	100	Lambeth	100 0 0	6 5 0	123 —125
1161	100	Do.	20 0 0	6 5 0	
442	100	New River	100 0 0	8 0 0	170 —180
4475	100	Do.	30 0 0	8 0 0	50 — 55
400000	100	Do., debenture stock, 4 per cent.	100 0 0	4 0 0	97 — 99
3036	100	Southwark and Vauxhall	100 0 0	5 5 0	104 —106
1296	100	Do., preference stock	100 0 0	5 0 0	101 —103
	100	Do., D shares	100 0 0	5 5 0	95 — 97
		Do.	..	4 10 0	
	10s	Do., new ordinary	..	4 10 0	
1600	100	Do., new ordinary, No. 1	40 0 0	4 10 0	
12172	61	West Middlesex	61 0 0	£6 per sh.	125 —126

APPLICATIONS FOR LETTERS PATENT.

2675.—Browne, S. G., Kilburn, and Moore, A., Euston Road, London, "Improvements in pipe-wrenches." Aug. 1, 1874.
2692.—Rigby, J., and Rigby, J., Manchester, "Improved apparatus for lighting and ventilating." Aug. 4, 1874.
2694.—Aldous, E., Peckham, Surrey, "A new or improved apparatus for preventing the waste of water in cisterns, tanks, and such like receptacles." Aug. 4, 1874.
2698.—Clayden, S., Faringdon, Berks, "A new or improved compound regulating-governor gas-generator." Aug. 4, 1874.
2711.—Else, G. E., Horsforth, Yorks, "Improvements in valves or cocks." Aug. 5, 1874.
2738.—Browning, T., Whitechapel, and Scott, G. J., Mile End, London, "An improved slide-valve." Aug. 7, 1874.
2742.—Payton, W., Shelgate Road, Surrey, "Improvements in valves for controlling the delivery of water or other liquids from or into pipes, cisterns, tanks, or other vessels or apparatus." Aug. 7, 1874.
2758.—Scott, J. P., Manchester, "Improvements in motive-power engines, applicable also for pumping." A communication. Aug. 10, 1874.
2797.—Jones, F. St. J., Worcester, "Improvements in taps and valves for regulating the flow of gas and other fluids." Aug. 13, 1874.
2802.—Henry, M., Fleet Street, London, "Improvements in the method of and apparatus for obtaining ammonia from waste products and other matters." A communication. Aug. 13, 1874.

GRANTS OF PROVISIONAL PROTECTION.

2461.—Spence, W., Chancery Lane, London, "Improvements in the treatment of liquid sewage in order to fix the azote and phosphate substances contained therein and convert them into solid matter, and in apparatus for the same." A communication. July 14, 1874.
2567.—Willett, G., Harris, R. J., and Lund, J., Worthing, "Improvements in filtering sewage, and in the means for effecting the same." July 22, 1874.
2587.—Aitken, H., Falkirk, N.B., "Improvements in the manufacture of illuminating gas, and in the apparatus or means employed therefor." July 24, 1874.
2605.—Wise, W. L., Adelphi, London, "Improvements in stop-valves." A communication. July 25, 1874.
2618.—Gaukroger, J., Todmorden, Fielden, S., Walsden, and Aitchison, A., Manchester, "Improved apparatus for generating gas for lighting, heating, and cooking." July 27, 1874.
2631.—Budenberg, A., Manchester, "Improvements in illuminated pressure and vacuum gauges." A communication. July 28, 1874.
2642.—Tweddle, H. W. C., New York, U.S.A., "Improvements in the manufacture of paraffin and illuminating and lubricating oils from petroleum." July 29, 1874.
2666.—Mushet, R. F., Cheltenham, "Improvements in the method of raising water and other fluids, and in the construction and arrangement of apparatus for that purpose." July 31, 1874.
2675.—Browne, S. G., Kilburn, and Moore, A., Euston Road, London, "Improvements in pipe-wrenches." Aug. 1, 1874.
2692.—Rigby, J., and Rigby, J., Manchester, "Improved apparatus for lighting and ventilating." Aug. 4, 1874.
2694.—Aldous, E., Peckham, Surrey, "A new or improved apparatus for preventing the waste of water in cisterns, tanks, and such like receptacles." Aug. 4, 1874.
2698.—Clayden, S., Faringdon, Berks, "A new or improved compound regulating-governor gas-generator." Aug. 4, 1874.
2711.—Else, G. E., Horsforth, Yorks, "Improvements in valves or cocks." Aug. 5, 1874.
2717.—Haseltine, G., Southampton Buildings, London, "An improved method of and apparatus for effecting the illumination of compass-cards, clock-dials, and steam and water gauges, and for other like purposes." A communication. Aug. 5, 1874.

NOTICES TO PROCEED.

1061.—Brown, M. H., New Cross, Kent, and White, M. G., Landport, Hants, "An improved disinfecting and deodorizing apparatus for water-closets and other purposes." March 26, 1874.
1079.—Nuttall, F. D., St. Helen's, Lancs, "Improvements applicable to regenerative and other gas-furnaces." March 28, 1874.
1169.—Voisin, J. A., and Dronier, P., Paris, "An improved method of and apparatus for producing a light." April 4, 1874.
1171.—Short, T., Glasgow, "Improvements in apparatus for purifying sewage." April 4, 1874.
1207.—Peters, S., and Donald, W., Glasgow, "Improvements in and connected with water-closets, and in part applicable for the supply or discharge of various liquids." April 7, 1874.
1824.—Bell, J., Wishaw, N.B., "Improvements in distilling coal shale for the production of oil and gas, and in the apparatus employed therein." May 23, 1874.
2243.—Bischof, G., Glasgow, "Improvements in the construction of filters and in the preparation of materials used for the purification of water." June 29, 1874.
2246.—Murdoch, H. H., Staple Inn, London, "Improvements in closing the ends of metal pipes, and in connecting and soldering metal pipes together, and in the combination of metals or alloys for the latter purpose; parts of which improvements are applicable to other purposes." A communication. June 29, 1874.
2450.—Scott, H. Y. D., Ealing, Middlesex, "Improvements in the recovery of carbonate of ammonia from sewage." July 13, 1874.
2495.—Newton, W. E., Chancery Lane, London, "Improvements in the manufacture of inflammable gas for illuminating and other purposes, and in the apparatus to be used therein." A communication. July 16, 1874.
2520.—Johnson, J. H., Lincoln's Inn Fields, London, "Improvements in the separation of ammonia from illuminating and other gases." A communication. July 18, 1874.
2563.—Clark, A. M., Chancery Lane, London, "Improvements in steam-pumps." A communication. July 22, 1874.
2566.—Moult, F. V., Leicester Square, London, "Improvements in apparatus for heating and ventilating dwelling-houses and other buildings." July 22, 1874.
2572.—Forbes, Rev. G. H., Broughton, Northampton, "Improvements in the manufacture of gas for illuminating and heating purposes." July 22, 1874.
2618.—Gaukroger, J., Todmorden, Fielden, S., Walsden, and Aitchison, A., Manchester, "Improved apparatus for generating gas for lighting, heating, and cooking." July 27, 1874.
2642.—Tweddle, H. W. C., New York, U.S.A., "Improvements in the manufacture of paraffin and illuminating and lubricating oils from petroleum." July 29, 1874.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

499.—Underhay, F. G., Clerkenwell, London, "Improvements in bib-cocks or cocks for drawing off water." Feb. 7, 1874.
565.—Hazeldine, F., Borough, Surrey, "An improved valve or tap for liquids and other purposes." Feb. 14, 1874.
567.—Richards, W., Brixton, Surrey, "Improvements in regulating the supply of fluids and liquids for the manufacture of illuminating gas, and for the apparatus employed therein." Feb. 14, 1874.
598.—Yarrow, E. H., Camberwell Park, Surrey, "Improvements in the manufacture of gas, and in the apparatus connected therewith." Feb. 17, 1874.
641.—Holland, H., Birmingham, "Improvements in the manufacture of gas for illuminating and heating purposes." Feb. 19, 1874.
643.—Trueman, H. P., Woodbridge, Suffolk, "Improvements in apparatus for measuring liquids." Feb. 20, 1874.
653.—Scott, H. Y. D., Ealing, Middlesex, "Improvements in the treatment of sewage, and in the manufacture of manures therefrom." Feb. 20, 1874.
1002.—Smith, A., Loughborough Road, Surrey, "Improvements in the means for purifying water, also applicable for preventing incrustation in steam-boilers, and for detergent purposes." March 23, 1874.
1983.—Dann, J. T., Brixton, Surrey, "Improvements in the construction of apparatus for lighting, extinguishing, and regulating gas-flames." A communication. June 8, 1874.
2034.—Cliff, W. D., Wortley, near Leeds, "Improvements in machinery for making clay retorts and other similar heavy articles made from clay." June 11, 1874.
2169.—Lake, W. R., Southampton Buildings, London, "An improved process and apparatus for making illuminating gas." A communication. June 22, 1874.
2209.—Haseltine, G., Southampton Buildings, London, "Improvements in gas-engines." A communication. June 25, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1937.—Preston, F. P., Prestige, J. T., Preston, E. J., and Prestige, W. A., "Improvements in waste-water preventer cisterns." July 22, 1871.
2025.—Hancock, D., and Pearse, C., "Improvements in the production of lighting gas, and in apparatus therefor." Aug. 1, 1871.
2033.—Chameroy, E. A., "Improvements in apparatus for regulating the pressure in delivery-pipes of water, gas, steam, and other fluids." Aug. 2, 1871.
2062.—Croll, A. A., "Improvements in meters for measuring water or other fluids." Aug. 4, 1871.
2076.—Barclay, A., "Improvements in coking coal, and generating gas for heating and other purposes, and in the apparatus employed therefor." Aug. 5, 1871.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

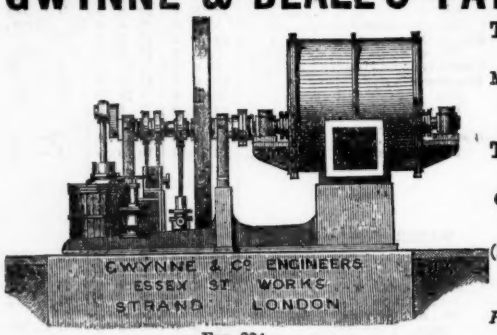


FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of GAS-EXHAUSTING MACHINERY.

(It is NOT CORRECT to state that Mr. BEALE has RETIRED.)

Prices and every information on application.

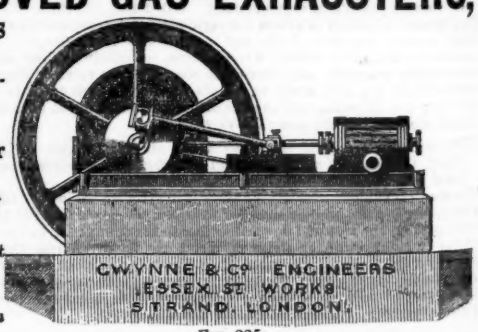


FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. Gwynne and Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 *cubic feet Patent Gas Exhausters, and many of all sizes.*

WANTED, a steady, sober, industrious man as STOKER. Wages 24s. 6d. per week. Apply to Mr. T. H. BOUTTELL, Gas-Works, SLEAFORD.

WANTED, by a young Man, a situation as METER-FIXER, Fitter, Index-Taker, Service-Layer, &c.
Address C. S., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a situation as Manager of a small Gas-Work. Used to fitting meters, inspecting, and the general work of a gas plant. Good reference. Aged 32.
Address A. E., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by an active, energetic young man, aged 30, a situation as METER INSPECTOR, Index-Taker, &c. Is a thoroughly experienced gas-fitter. First-class references as to character and ability.
Address W., 7, Cyril Street, Arthur Street, WALWORTH.

WANTED, for a Gas-Work abroad, as ASSISTANT to the Manager, a well-educated young man, with some experience of Gas-Works and accounts. A liberal salary will be given.
Address A. A., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a leading Stoker in a Gas-Work, where clay retorts are used and the annual make of gas is about 13 millions.
Apply, by letter, stating wages required, and enclosing references, to Mr. JOHN BUDDEN, Manager, Poole Gas-Works, DORSETSHIRE.

WANTED, a steady Man for a small Gas-Work. No fitting required. Wages 16s. per week, with free house, garden, fuel, and light. Extra help found during winter season.
Applications, with testimonials from last employers, to be made on or before the 26th of August, to C. H. PITFIELD, Rothwell, near KETTERING.

WANTED, by a Gentleman, aged 27, a situation as MANAGER, on the Continent or abroad. Advertiser has been four years in present situation, where the make is above 90,000,000 feet per annum. Understands the manufacture and distribution of gas in all its branches. Speaks French and Italian. Leaving present situation on account of salary being insufficient.
Address SCIENCE, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

VINCENT'S
PATENT IMPROVEMENTS
IN
Apparatus for Manufacturing Gas.
Particulars to be obtained by application to—
MR. LAYARD JONES,
ENGINEER,
25, OLD BROAD STREET, LONDON, E.C.

WANTED, by a young Man, aged 36, a re-engagement as WORKING MANAGER of a Gas-Work. Thoroughly understands the manufacturing and distribution of gas, main and service laying, fixing and taking meters, and the general work of a gas plant; 20 years experience. First-class testimonials.
Address A. B., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CARBONIZING Foreman Wanted, for a large work. None but experienced men need apply. State experience and wages required. Advertiser would agree to pay according to result.
Address H. R., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Advertiser, the son of a Gas Manager, 23 years of age, desires an engagement as ASSISTANT ENGINEER or Manager. Is a fair draughtsman. Has had three years experience in the manufacture of sulphate of ammonia. Can furnish testimonials as to ability.
Address A. B., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVANTAGES OF GAS FOR COOKING AND HEATING,
BY
MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their gas consumers.
Specimen Copy by post 4d., direct from MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

GLOUCESTER GAS COMPANY.

THE Directors of the above Company invite TENDERS for the excavation and brickwork required in the formation and completion of a GASHOLDER TANK, 135 ft. diameter and 35 ft. deep.
Plans and specification may be seen on application to the Company's Engineer, at the works.
Sealed tenders, endorsed "Tender for Brick Tank," to be sent in on or before the 20th inst.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
R. MORLAND, Engineer.
Gas-Works, Gloucester, Aug. 6, 1874.

Now ready, price 7s., by Post 7s. 3d.,
A SECOND EDITION (fcap. 8vo., morocco gilt)
OF
THE GAS MANAGER'S HANDBOOK;
CONSISTING OF
Tables, Rules, and Useful Information for Gas Engineers, Managers,
And others engaged in the Manufacture and Distribution of COAL GAS.
BY THOMAS NEWBIGGING, A.I.C.E.

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

WANTED, two Purifiers and Covers, 4 ft. 6 in. by 6 ft. 6 in., or thereby, and a Central Valve with 4-in. connexions, to work four purifiers, three on and one off, and a 1000 feet per hour Station-Meter.
Apply, with price, to X. O. X., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, a set of Four Dry Lime Purifiers, 7 ft. diameter, 3 ft. deep, 4 tiers of wrought-iron sieves, hydraulic centre-valve, 9-in connexions and lifting apparatus for covers. The above are in good working order, and are offered for sale on account of their being replaced by larger ones.
Apply to E. LORD, Whitworth Vale Gas Company, near ROCHDALE.

PURIFIERS FOR SALE.

TO BE SOLD, by Tender, four Purifiers, 7 ft. by 7 ft. by 3 ft. 9 in. deep, with Hydraulic Centre-Valve and 6-in. connexions.
The Purifiers are fitted with wood sieves, cast-iron covers, excellent lifting and travelling gear. Possession may be had on or about Oct. 1, 1874.
For particulars apply to J. R. SMITH, Gas-Works, Padiham, Lancashire.
Tenders to be sent in by Sept. 3, 1874.
Padiham, Aug. 10, 1874.

TAR AND AMMONIACAL LIQUOR.

THE Gas-Works Committee of the Widnes Local Board are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR, to be produced at their Gas-Works, Widnes, for a period of One year, from the 1st of October next.
The Tar and Liquor will be delivered on rails at Widnes.
Forms of tender, and other particulars, may be obtained on application to the undersigned, at the Gas-Works, Widnes.
Tenders to be addressed to the Chairman of the Gas-Works Committee, endorsed "Tender for Tar" or "Liquor," as the case may be, and to be delivered at the Gas-Works, Widnes, not later than the 29th inst.
N.B.—Tenders other than on the prescribed form will not be accepted, and the Board do not bind themselves to accept any tender.
T. A. DREW,
Gas-Works, Widnes, Engineer and Manager.
August, 1874.

IN consequence of the removal of Northumberland House, my Chambers are now No. 4, CANNON ROW, PARLIAMENT STREET, S.W.
Friends please take notice, and oblige
GEORGE ANDERSON.

BOROUGH OF ROTERHAM GAS-WORKS.

IN consequence of alterations and additions to the above works, the Corporation have FOR SALE the following GAS APPARATUS—viz.: Station-Meter in ornamental square case, 6 ft. 6 in. by 6 ft. 6 in., made by West and Gregson in 1855, thoroughly repaired in 1865, inlet and outlet 8 inches, with hydraulic valves and bye-pass, also a station-meter in round case, 4 ft. 9 in. diameter, made by West and Gregson.
12 Hydraulic Mains in cast-iron, 10 ft. 5 in. long by 16½ in. by 16½ in. wide, at per cwt., at the Gas-Works in Rotherham.
Also 6 metal Covers to same, at per cwt.
Also 56 metal H-Pipes, size 4 in., at per cwt.
Also 17 metal Mouthpieces, 23 in. by 15 in., at per cwt.
Also 17 metal Mouthpieces, 21 in. by 14 in., at per cwt.
Further particulars may be had of Mr. James Goodwin, Manager, at the Gas-Works, Rotherham.
Sealed tenders to be sent to me not later than the 15th of August next.
By order,
W. WHITFIELD, Town-Clerk.
Corporation Offices, Rotherham, Aug. 8, 1874.

CANNEL.

THE West Yorkshire Iron and Coal Company, Limited, will be glad to receive FORMS for TENDERS from Gas Companies and others requiring a supply of CANNEL.
Address, 72, Wellington Street, LEEDS.

CITY OF CARLISLE.

TENDERS FOR COALS.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of from 6000 to 8000 tons of best GAS COALS or NUTS, delivered in such quantities as may be directed from September, 1874, to March, 1875.
The Coals or Nuts are to be the best of their kind, and free from sulphur, bats, bind, refuse, and dust, and must be delivered free at the London Road Station, the Lancaster Street Station, or at the Currock Street Coal Depôt, Carlisle.
Tenders for the whole or part of the above quantities may be submitted. Payments will be made monthly if, and so long as, the contract shall be duly fulfilled.
Sealed tenders, specifying the description of Coals, and the pits at which they are to be raised, and stating the prices for deliveries at the above-named places, must be endorsed "Tender for Coal," and delivered to me on or before the 31st inst.
J. HEPWORTH, Manager.
The Gas-Works, Carlisle, Aug. 14, 1874.

Just published, price 2d.,

AN ADDRESS TO MEMBERS OF WORKING MEN'S INSTITUTES, by GEORGE ANDERSON, Esq., Gas Engineer, London; delivered at the Burnley and Leven Institutes. To be had of Mr. HUNTER, Walton's Buildings, Healy Wood, Burnley, LANCASHIRE. One copy sent by post on receipt of 2½d. in stamps.
"We recommend every working man to possess himself of one of these admirable little pamphlets."—*Burnley Gazette.*

COTTERILL'S PATENT STEEL TUBE-DRILLS, for connecting services to water, gas, and steam mains and boilers under pressure, without any escape of water, gas, or steam. They drill and tap themselves, and are left in the mains. The connexion is therefore perfect.
For prices and other information apply to CHARLES FORSTER COTTERILL, Finney House, Cannock, STAFFORD, Patentee.

ALFRED WILLIAMS,
PHŒNIX FIRE-BRICK WHARF,
64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

SPENCE BROS. CHEMICAL COMPANY, LIMITED,
MANUFACTURERS OF
SULPHATE OF AMMONIA, VITRIOL, PATENT DRY COPPERAS, &c.
PURCHASERS OF
SPENT OXIDE AND AMMONIACAL LIQUOR;
AND CONTRACTORS FOR THE
PURIFICATION OF COAL GAS.
ALL COMMUNICATIONS TO
VICTORIA CHEMICAL WORKS, BRADFORD, MANCHESTER.

EASTWOOD & CO.,
LIMITED,
Wellington Wharf, Belvedere Road, Lambeth,
AND
Canal Bridge Wharves, Old Kent Road, S.E.
LIME, CEMENT, AND BRICK MANUFACTURERS
AND MERCHANTS.
SHOEBURY AND KENT STOCKS, AND SUFFOLK RED AND WHITE BRICKS DELIVERED IN ANY QUANTITIES, OR BY BARGE ALONGSIDE.

Stourbridge, Newcastle, and Welsh FIRE-BRICKS and LUMPS of all descriptions.

Malam and Moulded Bricks, PORTLAND CEMENT (made from the Medway Earth, &c.) of UNSURPASSED quality.

Grey Stone Lime, FLARE LIME Chalk Lime, Blue Lias, Roman and other Cements.

ALSO
BUILDING GOODS OF ALL DESCRIPTIONS.

WARNER AND COWAN'S
SELF-REGULATING GAS-METER.

PRACTICALLY UNVARYING MEASUREMENT WITH VARYING WATER-LINE.

Upwards of 60 cubic inches of Water may be withdrawn from a 3-light non-fountain Meter, and Registration not lessened.

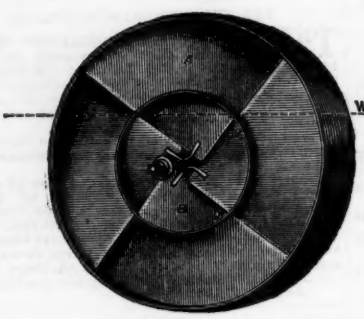


Fig 1.
Front View of Drum, with hollow Cover removed.

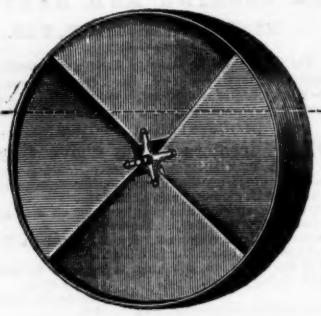


Fig. 2.
Back View, same as Ordinary Meter.

Fig. 3.
Back removed, showing Inner Drum.

BY LETTERS PATENT
FOR
GREAT BRITAIN,
FRANCE,
AUSTRIA,
PRUSSIA,
BELGIUM,
AND THE
UNITED STATES OF AMERICA.

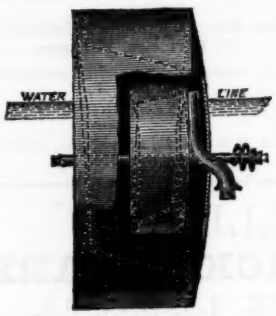


Fig. 4.
Side View, partly in Section.

MORE THAN THE
ADVANTAGES
OF COMPENSATING METER,
WITH
SIMPLICITY OF
COMMON METER,
AND
INCREASED RANGE
OF FLOAT.

DESCRIPTION.

The measuring portion of the ordinary Wet Meter drum, when in action, is but an annulus, varying in its capacity with the water level.

In the "PATENT SELF-REGULATING DRUM," one-half of this annulus, A, is made rigid and unvarying by the insertion of the smaller measuring-drum, B, which is of similar construction to the large one, but with its chambers so arranged that its inlet-hoods, *i i i i*, fig. 3, are within the chambers of the latter, and its outlet-hoods, *o o o o*, fig. 1, within its cover.

The quantity of gas discharged at each revolution is practically the contents of the annulus, A, bounded by a circle corresponding with the periphery of the small drum, because the gas contained between the water-line and that point (in the portion of large drum which the small one does not occupy) passes into the latter, and is returned under the cover to be remeasured, along with the supply entering by the spout.

It follows that any alteration of the water-level will affect both drums equally, and make no practical difference in the quantity passed. The lights also will be found quite steady, and the difference of pressure between inlet and outlet practically the same as in the ordinary Wet Meter. Large Meters also can now be made *with* floats.

SOLE LICENSEES AND MANUFACTURERS:

W. & B. COWAN,

ESTABLISHED 1827.

KING HENRY'S WALK,
BALL'S POND ROAD,
NEAR DALSTON JUNCTION STATION.
LONDON, N.

BUCCLEUCH ST. WORKS,
EDINBURGH.

FOR RESULT OF TESTING, SEE OPPOSITE PAGE.

WARNER AND COWAN'S SELF-REGULATING GAS-METER.

Certificate by Mr. G. MILLS,

METER INSPECTOR TO THE METROPOLITAN BOARD OF WORKS.

Meter Inspector's Office, St. Ann's Street, Westminster, S.W., Aug. 7, 1874.

Gentlemen,—The 3-light Patent Wet Meter sent to this office has been tested by me at ·5 and 1·0 inch pressures, and at the extreme range of the water-lines I find only a difference of 0·62 per cent. in its registration. I am, gentlemen,

Yours obediently,

Messrs. Cowan. G. MILLS.

Certificate by Mr. G. DETHRIDGE,

METER INSPECTOR TO THE METROPOLITAN BOARD OF WORKS.

Meter Testing Office, Southwark Street, London, Aug. 13, 1874.

Gentlemen,—I have submitted the Three-Light Wet Meter (makers, Badge, Warner, and Cowan), No. 86, Self-Regulating Drum, to the following tests, 18 feet per hour passing through the meter at each test—viz., at ½-inch pressure, with the water filled up to the overflow of the waste-box, then at 1, 1½, 2, 2½, and 3 inches pressure. One half pint of water was drawn off, and the tests repeated; a second half pint was drawn, and the tests repeated; a third half pint of water was drawn off, the tests again repeated; and a fourth half pint was taken out with a repetition of the tests.

The results were carefully noted, and a second series of tests were carried out, confirming the original experiments.

The results are appended:—

Rate Per Hour 18 *Cubic Feet.*

Pressure.	At High Water Level	With Half a Pint off.	With One Pint off.	With One and a Half Pint off.	With One Quart off.
5-10ths	0·20 fast	0·30 fast	0·80 fast	0·60 fast	0·60 fast
10 ,,	0·40 ,,	0·20 ,,	0·20 ,,	correct	0·20 slow
15 ,,	0·20 ,,	correct	correct	,,	correct
20 ,,	0·40 ,,	0·60 fast	0·40 fast	0·40 fast	0·40 fast
25 ,,	0·40 ,,	correct	correct	0·20 slow	correct
30 ,,	0·20 ,,	,,	0·20 slow	correct	,,

(Signed) G. DETHRIDGE.

Messrs. W. and B. Cowan.

Certificate by Mr. B. M. M'CRAE,

ENGINEER TO THE DUNDEE GAS COMMISSIONERS.

Dundee Gas Commission, Engineer and Manager's Department, Dundee, Aug. 10, 1874.

Gentlemen,—We received sample meter, Warner and Cowan's Patent 3-light, which we have subjected to several tests, of which the following are the results:—

True water-line . .	1	per cent. fast at	5-10ths pressure.
Do. do. . .	1	,, ,,	10-10ths ,,
Do. do. . .	Net		20-10ths ,,
Do. do. . .	Net		30-10ths ,,
7 gills off . . .	1	per cent. fast at	5-10ths ,,
Do. . . .	Net		10-10ths ,,
Do. . . .	1	per cent. fast at	20-10ths ,,
Do. . . .	1	,, ,,	30-10ths ,,

These results are very satisfactory, and prove that said meter, so far as I am aware, surpasses anything that has hitherto been produced. I am, gentlemen, yours, &c.,

(Signed) B. M. M'CRAE.

Messrs. W. and B. Cowan.

Certificate by Mr. R. FERRIER,

METER INSPECTOR, EDINBURGH.

Inspector of Meters Office, City Chambers, Edinburgh, Aug. 13, 1874.

Gentlemen,—I herewith beg to append the results of my testing from the 8th inst. to this date, 5-light, No. 183,127, Warner and Cowan's Patent Drum *Non-Compensating* Gas-Meter.

These are the average results of many experiments, which I must say varied very little.

I find that the Meter supplies its full quantity, and the valve does not close until upwards of 14 gills of water are extracted.

I am, gentlemen, yours respectfully,

(Signed) R. FERRIER,
Chief Inspector of Meters, Edinburgh.

Messrs. W. and B. Cowan.

1.—*When Filled with Water to Overflow.*

Pressure on Gasholder.	Pressure on Exit.	Capacity per Revolution ·25 Cub. Ft. Per Hour 30 Feet.	Per Centage. Fast.	Slow.
0·5 in. ..	0·10 in. ..	—	0·5 ..	—
1·0 in. ..	0·55 in. ..	—	0·6 ..	—
2·0 in. ..	1·6 in. ..	—	0·5 ..	—
3·0 in. ..	2·6 in. ..	—	0·5 ..	—
	2.—*Four Gills of Water off.*			
0·5 in. ..	0·10 in. ..	—	— ..	0·3
1·0 in. ..	0·55 in. ..	—	— ..	0·4
2·0 in. ..	1·6 in. ..	—	— ..	0·2
3·0 in. ..	2·6 in. ..	—	— ..	0·2
	3.—*Eight Gills of Water off.*			
0·5 in. ..	0·10 in. ..	—	0·2 ..	—
1·0 in. ..	0·55 in. ..	—	Net. ..	—
2·0 in. ..	1·6 in. ..	—	0·4 ..	—
3·0 in. ..	2·6 in. ..	—	Net. ..	—
	4.—*Twelve Gills of Water off.*			
0·5 in. ..	0·10 in. ..	—	0·5 ..	—
1·0 in. ..	0·55 in. ..	—	0·3 ..	—
2·0 in. ..	1·6 in. ..	—	0·5 ..	—
3·0 in. ..	2·6 in. ..	—	0·5 ..	—

Certificate by Dr. WALLACE, F.R.S.E., F.C.S.,

GAS EXAMINER FOR THE CITY OF GLASGOW.

Chemical Laboratory, 42, Bath Street, Glasgow, Aug. 3, 1874.

I have made a careful examination of a 3-light Warner and Cowan's Self-Regulating Gas-Meter, and I have no hesitation in saying that it is the most perfect meter that has come under my notice. The construction is beautifully simple, and the works are not more liable to accidental derangement than those of the common wet meter. While an ordinary 3-light meter gave a variation in the registration of 5 per cent. when tested at the high and low water levels, with a difference of 3½ gills of water, the Patent Meter, with a difference of 7¼ gills, or 62·8 cubic inches in the quantity of water, varied in the registration only ·2 per cent. These tests apply to the ordinary half-inch pressure, at which meters are tested according to the Act of Parliament, but an increase to a working pressure of 3 inches gave results equally favourable to the Patent Meter. The common wet meter showed a variation in the registration by the increase of pressure of 1 to 1·5 per cent., according to the level of the water, while the Self-Regulating Meter gave a variation resulting from the increase of pressure of ·6 at the high level to 1 per cent. at the low level. The greatest error at any pressure and any level of water was, with the common meter, 3·8 per cent., and with the Patent Meter, ·8 per cent.

The following is a statement of the various trials to which the Patent Meter was subjected:—

	Highest Level.	2 Gills off.	4 Gills off.	6 Gills off.	7½ Gills off.
At half-inch pressure ..	·8 ..	·4 ..	·4 ..	·8 ..	·6 fast.
At 3 inches pressure ..	·2 fast	— ..	— ..	— ..	·4 slow.

Such extremely accurate performance, combined with such an extensive variation in the quantity of water, leaves nothing further to desire in the measurement of gas.

WILLIAM WALLACE.

Mr. ALFRED LASS,

60, CORNHILL, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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REGISTRATION OF DISTRIBUTORY PLANT.

The forms for this purpose are to illustrate the Paper on Distribution of Gas, read at the Edinburgh Meeting of the British Association of Gas Managers. By the use of the synopsis the whole of the out-door plant may at once be seen, with all matters pertaining to the same.

W. J. WARNER, Engineer.

South Shields.

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EXTENSIONS AND ALTERATIONS,
DRAWINGS AND TRACINGS OF GASHOLDERS,
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Dibdale Fire-Clay Works & Colliery,
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(ESTABLISHED 1834.)
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Red and Blue Clay Goods, Engineering and other Ironwork, and Fittings supplied.

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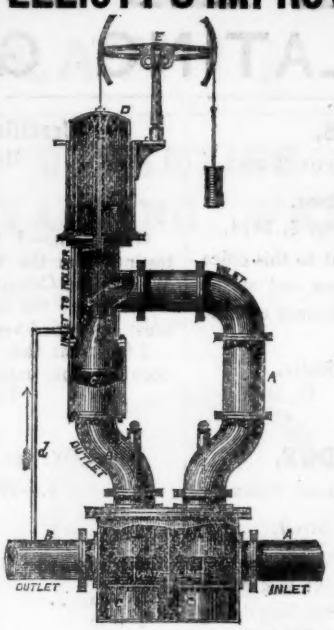

The advantages of this Governor are—

1. The entire absence of oscillation.
2. No danger of explosion.
3. Perfect uniformity of pressure.
4. Economy of space; a 15-inch holder being sufficient for a 10-inch Governor.
5. The holder can be placed at any height in relation to the cone.
6. It admits of a simple, effective, and cheap bye-pass arrangement.

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3 inch . .	£12 15 0	3 inch . .	£19 5 0
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5 „ . .	16 4 0	5 „ . .	25 15 0
6 „ . .	18 14 0	6 „ . .	28 10 0
7 „ . .	21 6 0	7 „ . .	33 0 0
8 „ . .	23 15 0	8 „ . .	38 10 0
10 „ . .	26 5 0	10 „ . .	44 0 0
12 „ . .	30 10 0	12 „ . .	48 0 0

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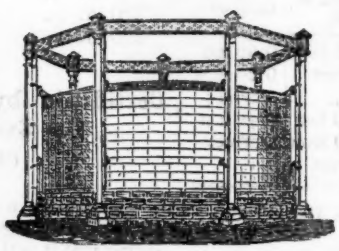

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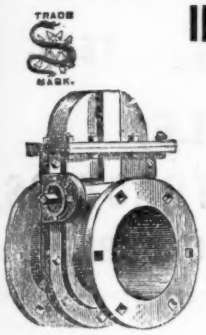

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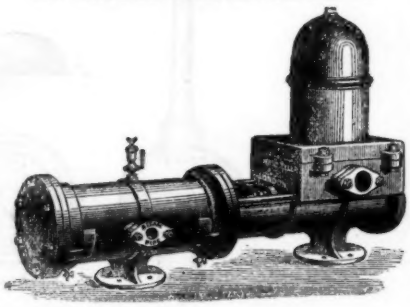

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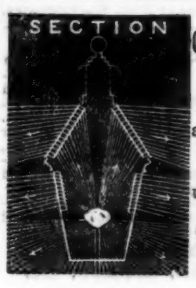

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Warranted the best quality.
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CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

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MANUFACTURE EVERY DESCRIPTION OF
GAS AND WATER FITTINGS;
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CLASS X.
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For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
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BEST GLASS-HOUSE POT AND CRUCIBLE CLAY;
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Competent workmen sent out to town or country.
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Proprietors of
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Successors to
E. BAKER AND CO. LATE BRIERLEY HILL, STAFFORDSHIRE.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.
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THE THAMES BANK IRON COMPANY,
(Successors to LYNCH WHITE,)
SUPPLY FROM STOCK
CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.
All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.
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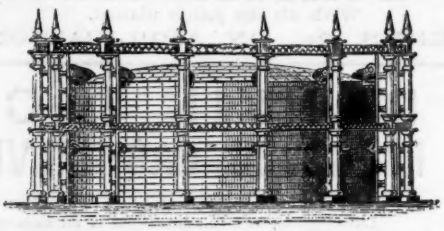
HOPE IRON WORKS,



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GAS ENGINEERS & CONTRACTORS,
MANUFACTURERS OF GASHOLDERS,
GAS APPARATUS OF EVERY DESCRIPTION,
Including Improved
Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,
And GENERAL IRONWORK.
N.B—Estimates for all Gas Plant and Remodelling supplied on application.

D. BRUCE PEEBLES & CO.'S
PATENT
LAMP REGULATOR

Fig.3.

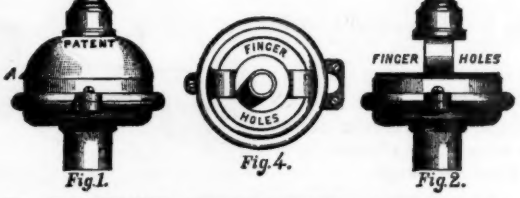

Fig.1. Fig.4. Fig.2.

D. BRUCE PEEBLES AND CO.,
ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS;
PATENTEES OF
GAS REGULATORS FOR PUBLIC LAMPS, FACTORIES, PUBLIC HALLS, AND DWELLING-HOUSES.

Attention is respectfully requested to the following extract from a lecture "On the Economical Combustion of Coal Gas," delivered to the Philosophical Society of Glasgow, by Dr. W. Wallace, F.R.S.E., F.C.S., Gas Examiner for the city of Glasgow, on the 4th of March last:—
"A few years ago, a simple form of Gas Regulator for Street Lamps was introduced, I do not know by whom, and various forms of it, and improvements on it, have been made by many practical gas engineers. Of all the modifications of the instrument, the best in my opinion is that of Mr. D. Bruce Peebles, of Edinburgh; in fact, his Lamp Regulators are so superior that they are likely to supplant all others. Already about 9000 of these have been applied to the street-lamps in Glasgow, and I understand it is the intention of the authorities to introduce them all over the town. The saving thereby effected I calculate to be about £6000 per annum, without any diminution of light. One of the great advantages of Mr. Peebles's apparatus over all others is that it can be regulated while the gas is burning."
Since the above date, another 1000 have been supplied to Glasgow, and they are being largely adopted at home and abroad.

D. B. P. and Co. are prepared to Estimate for the Supply and Maintenance of their Regulators, and will be glad to forward terms on application.
D.BRUCE PEEBLES AND CO.,
ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,
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MANUFACTURERS OF

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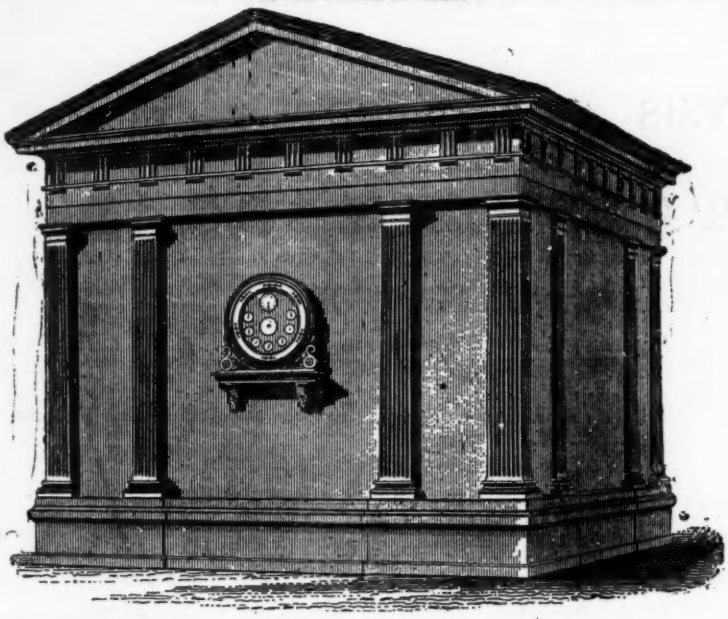
OF THE HIGHEST EXCELLENCE;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



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Orders almost invariably despatched on the day of receipt.

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Mr. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.

STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains Illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

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HUCKNALL COLLIERY COMPANY

Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

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LESMAHAGOW

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Supply the Best Wigan Arley Mine Gas Coal and Nuts; the Best Hand-picked Round Cannel;

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GENERAL CONTRACTORS & RETORT-SETTERS,

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RETORTS SET ON THE LATEST IMPROVED PLAN.

Retort-Setters sent to all parts of Europe and America.

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CAST-IRON GAS AND WATER PIPES.

MALLEABLE IRON TUBE FOR GAS, WATER, AND STEAM.

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DELIVERY F.O.B. ON CLYDE.

Lists on application.

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MANUFACTURERS OF

GAS and WATER PIPES,

Bends, Tees, and Irregulars,

AND

GENERAL FOUNDERS.

ESTIMATES and PRICES on APPLICATION.

WILSONTOWN GAS COAL.

This Coal bears a close resemblance to the Lesmahago seam. It has a first-class Coke, equal to the Lesmahago, and greater in quantity, and 10,538 Cubic Feet of 33·2 Candle Gas.

For rail in Scotland, or shipped at Glasgow, Leith, or Granton.

ANALYSIS AND REPORT

ON

CLIMPY TRIPPING COAL,

FOR GAS PURPOSES.

The results of this analysis, as shown below, were got from actual working, and we have therefore the utmost confidence in placing it, along with that annexed, before you.

COMMERCIAL RESULTS.

Gas per ton of Coal—temperature 60°—barometer 30 inches	10,200 cubic feet.
Coke per ton of Coal	1,400 lbs.
Durability of one cubic foot of the gas, by jet of 5-inch flame	48 min. 24 sec.
Illuminating power in standard candles	14·9

REMARKS.

Being well acquainted with Durham and Northumberland Coals, I have no hesitation in saying that "CLIMPY TRIPPING" is superior to any (containing, besides, a greater proportion of pieces from 7 to 14 lbs. weight), with far less impurities for purification, more gas, and coke equal in calorific power. It has a large mixture of cannel nuts, which accounts for the good quality of the gas, at our photometer in town, 1000 yards from the works.

It is also a very superior Coal for mixing with oils, as by Mackenzie's patent; or with acid tar, or tar oil, shale grease, or other refuse from paraffin-works, as by system of Mr. Scott, of Musselburgh, or Mr. Foster, Portobello, the Coal being easily crushed.

Below are the results realized by myself, when mixed with acid tar from paraffin work, received by me in a solid state, having been run on to very fine dross. My charges were 2 cwt. tripping and 28 lbs. of acid tar, each retort, running six hours; with lighter charges I get more gas, but not so good quality, or so much coke.

Gas per ton of Coal	10,800 cubic feet.
Coke per ton of Coal	1,540 lbs.
Durability of one cubic foot of gas, by jet of 5-inch flame	58 min. 28 sec.
Illuminating power in standard candles	27·29

The first truck received being tried with very light charges (unmixed), and running five hours, I got 10,500 cubic feet of 14-candle gas; and I am confident, practical managers, with good retort-fittings (mine being very inferior), and exhausters at work, as I have seen generally at home and abroad, will take 11,000 feet of 13-candle gas from it. My retorts are 8 feet × 2 feet × 14 inches, D shape, heavy dip, and no exhauster.

These remarks of mine you may perhaps think rather lengthy, but they will be the more intelligible to any manager inquiring for Climpy Tripping.

L. MONK,
Engineer and Manager.

Lanark Gas-Works, April 20, 1874.

GAVIN PAUL,

WILSONTOWN GAS COAL WORKS & CLIMPY COLLIERY,

BY CARNWATH, N.B.

G. J. EVESON,

GAS COAL MERCHANT,

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Delivery per Rail to any Part.

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GAS APPARATUS & MACHINERY

OF EVERY DESCRIPTION.

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DRY, CENTRE, AND BYE-PASS VALVES; WROUGHT-IRON AND CAST-IRON SCRUBBERS; ANNULAR AND PIPE CONDENSERS, ALL SIZES.

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Steam-Engines and Steam-Pumps.

RETORT SETTERS & FITTERS SENT TO ALL PARTS.

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COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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MUIRKIRK, No. 1, CANNEL

Yields 11,600 cubic feet of 34·3-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

MUIRKIRK, No. 2, CANNEL

Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing 11 per cent. of ash.

OLD WEMYSS CANNEL

Yields 12,550 cubic feet of 33-candle gas per ton.

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STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

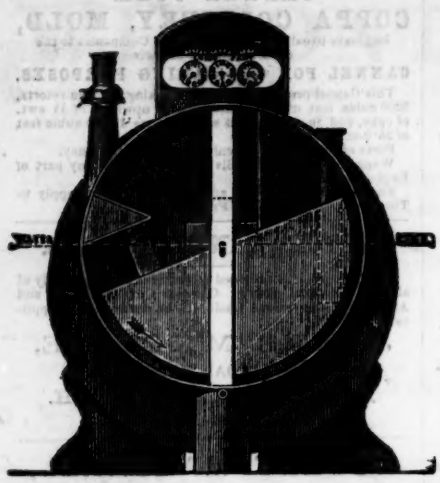
	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·9	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.



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"Unquestionably the best Water Gas-Meter now in use."—THOS. G. BARLOW, C.E.

Over 90,000 in action.

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WITH

Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS

of the highest excellence.

STATION-METERS AND GOVERNORS.

STREET-LAMP REGULATORS.

TESTING APPARATUS

of the most perfect description for all purposes relating to Gas.

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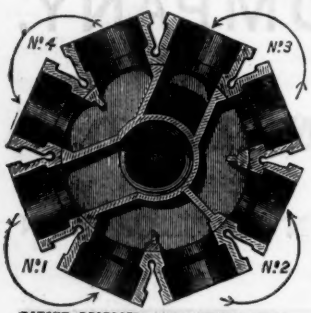

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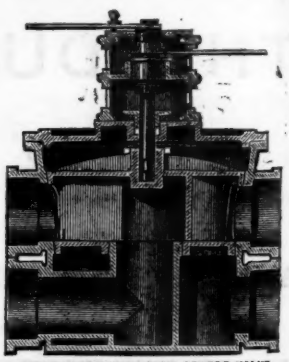

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